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Suspended Sediment Characteristics of Ohio Streams
. . . William L. Lamar and Charles R. Collier

Eleventh Annual Meeting, Soil Conservation Society of America—Tulsa, Oklahoma, October 15, 16, 17, 1956.

How to paint the country green

The new "soil bank" authorized by Congress has two primary functions.

The *acreage* reserve to reduce the amount of land in production

The *conservation* reserve to divert croplands to soil-building grasses or trees.

Authorities agree that this is one of the greatest incentives farmers have ever had to put tired croplands into soil-building grasses and legumes, or trees. Result: richer, greener, more productive lands.

Even though soil bank lands may not be used for grazing or forage at present, there will be renewed interest in basic grassland crops and improved practices in seed-bed preparation, fertilizing and seeding.

Already there exists a wide choice of dependable grasses and legumes that may be drawn upon for soil bank planting in every section of the country. These have been selected and adapted to regional and local soil, climate and other conditions through painstaking work by the USDA research activities, Soil Conservation services and private seedsmen and growers.

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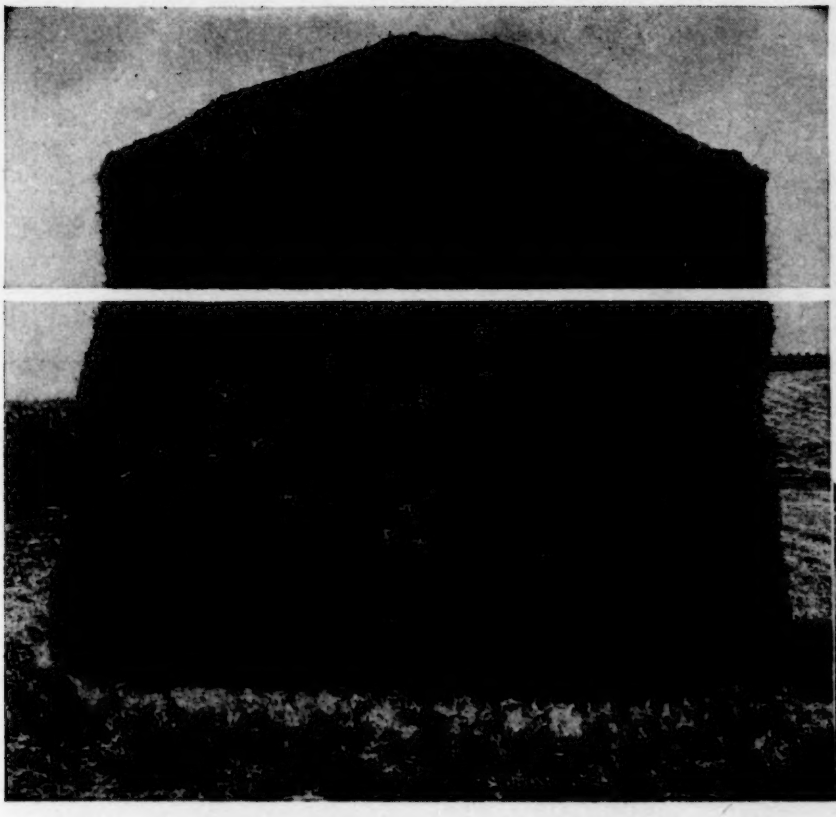

In experimental farm studies conducted in Washington State, the yield of alfalfa was increased nearly 40% by adding Moly to molybdenum-deficient soil. The fodder below the white line in the stack at the left indicates yield on moly-deficient soil. Volume above the line indicates increase produced by addition of Moly to soil. Photos courtesy of John Deere, Moline, Illinois.

How alfalfa yield has been stepped up nearly 40% by adding MOLYBDENUM to some acid Washington soils

Application of Sodium Molybdate to Moly-deficient soil, tests show, will result in sizeable yield increases

Scientific tests conducted by Dr. H. M. Reisenauer in Spokane County, Washington, have resulted in greatly increased yields of alfalfa. Investigations that began in 1952 have shown that poor forage yields were caused by Moly deficiency. Correction was made by adding one pound of sodium molybdate per acre. The applications were made in water solution, using a weed spraying outfit.

Other marked advantages result from the use of Moly

When alfalfa is grown in a Moly-deficient soil the plants tend to be stunted and pale green in color. Spots develop between the leaf veins, often spreading to affect the entire leaf. Such leaves finally die and fall off. When other conditions are favorable, these deficiency symptoms are corrected by the addition of available Moly to the soil, resulting in greater yields and more vigorous growth.

Tests here and abroad show that all crops need Moly

Thorough tests, made over the last 15 years, both in this country and in many foreign areas, have shown conclusively that all crops need Moly in a form which can be assimilated readily by the plant. If available Moly is not present in the soil in sufficient quantities, then it should be added either alone or combined with fertilizers.

Help offered for spotting and correcting Moly-deficiency

Specific experiments with dozens of different crops, ranging from citrus to sugar beets, proved that Moly deficiency exists in soils in many areas in the United States. In order to help you diagnose Moly Soil deficiencies in your territory, we will be glad to send you test samples of Sodium Molybdate. Write for MOLY TEST SAMPLES. Address Climax Molybdenum Company, Department 50, 500 Fifth Avenue, New York 36, N. Y.

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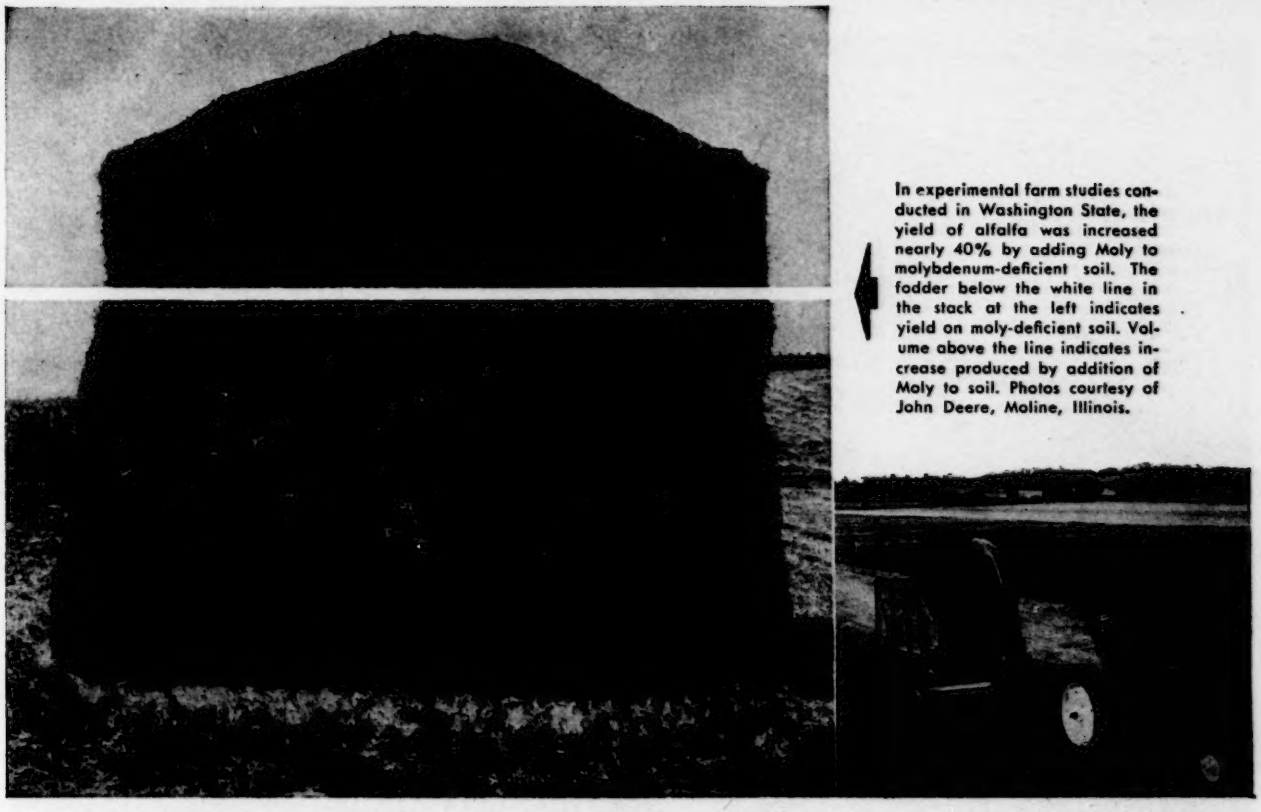

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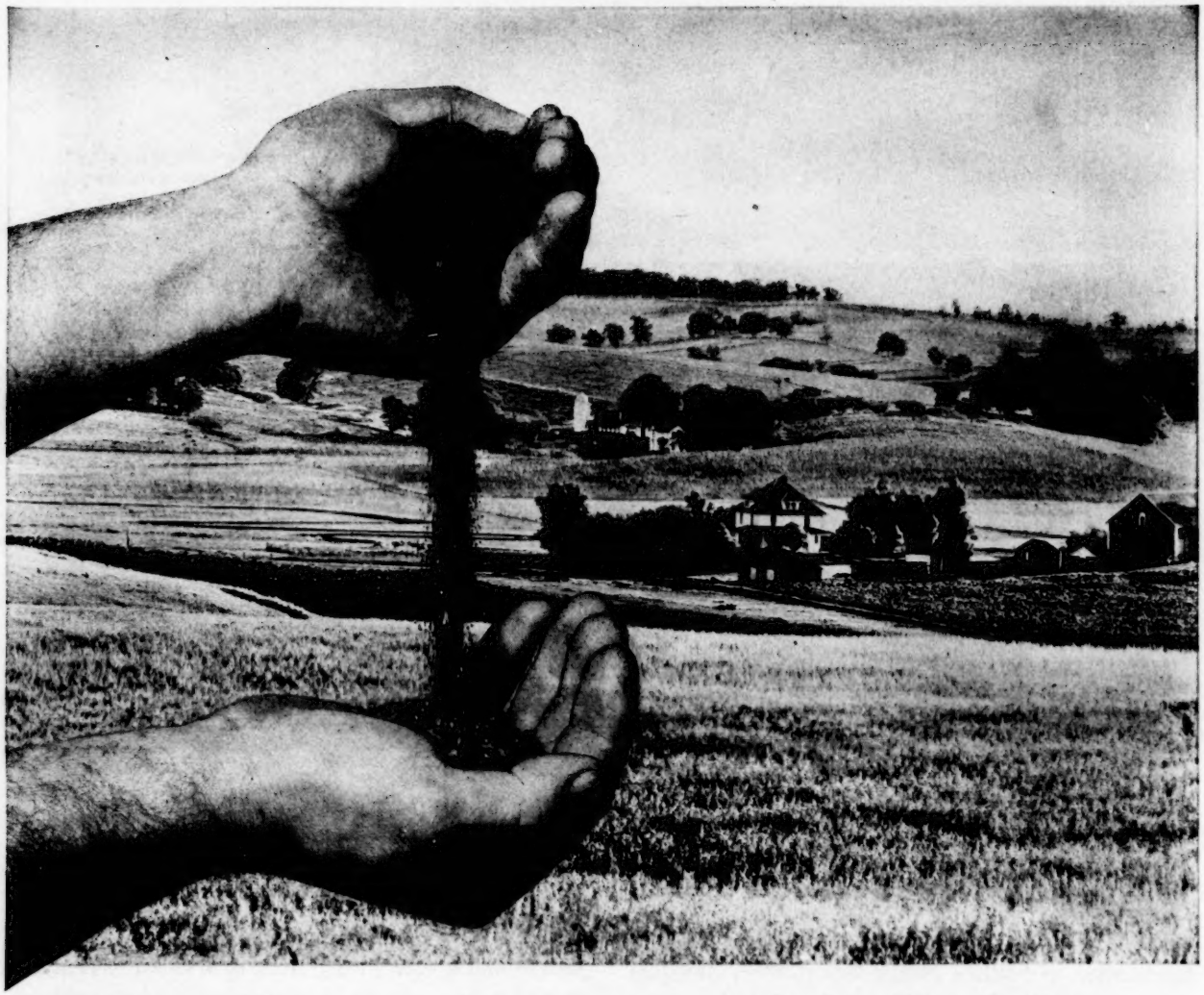

Our Future Rests on Soil Fertility

America has grown strong largely because her people have eaten well. Eating well means living well, working well. Those are facts that some of us may overlook. A thriving agricultural-industrial system has put meat and potatoes on our tables, white shirts on our backs, soft rugs on our living room floors.

Such necessities, and niceties, come largely from the soil. A lot of us need to think of that. We need to remember that a biscuit in the hand is just so much protein and starch and fat taken out of the soil; that much of our clothing grows on cotton stalks; that sheep are only walking factories, eating weeds and grasses and grains to grow wool on their bodies; that such a flimsy thing as a paper napkin represents a mite of soil resource taken away from our national stockpile of natural resources.

If we will look upon our day-to-day living in this light, we will understand why a nation growing toward a hundred and seventy million persons makes a terrific drain upon soil resources. We will realize why it is necessary for us to maintain the soil, even while using it.

Modern farm equipment makes the application of soil conservation practices both possible and profitable. It helps to put "a future in soil fertility."

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VOLUME 11
NUMBER 5

Journal of SOIL AND WATER CONSERVATION

TO ADVANCE THE SCIENCE AND ART OF GOOD LAND USE

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POST OFFICE ENTRY: Second class mail privileges authorized at Des Moines, Iowa.

MEMBERSHIP: Annual membership is on a calendar year basis and is $5.00 per year of which $1.50 is for subscription to the JOURNAL and 25c for NOTES AND ACTIVITIES. Subscription for the JOURNAL to libraries and others is $5.00 per year. Single copies are 85c each.

CORRESPONDENCE — Concerning manuscripts, books for review and other editorial matter should be sent to the Editor, P.O. Box 1392, Fairmont, West Virginia.

BUSINESS CORRESPONDENCE—Concerning remittances and questions should be sent to the Executive Secretary, 838 5th Avenue, Des Moines 14, Iowa.

CHANGE OF ADDRESS: Notice of change in address should be received two weeks before the date of issue on which the change is to take effect. Both the old and the new address should be sent to the office of the Secretary.

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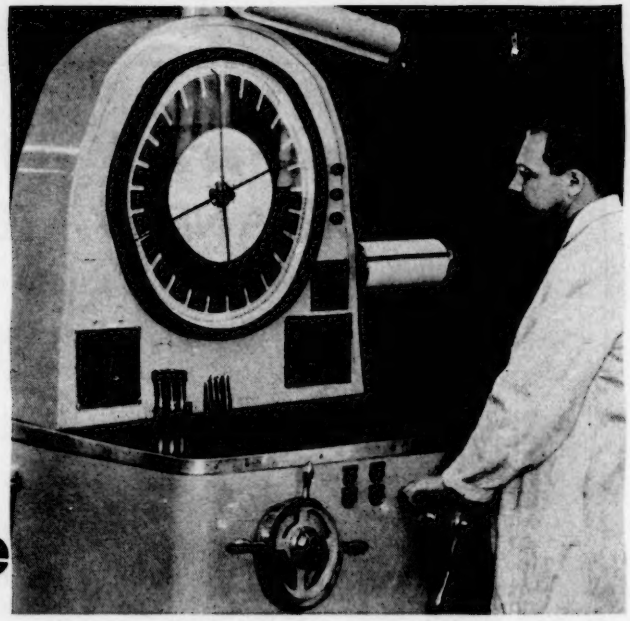

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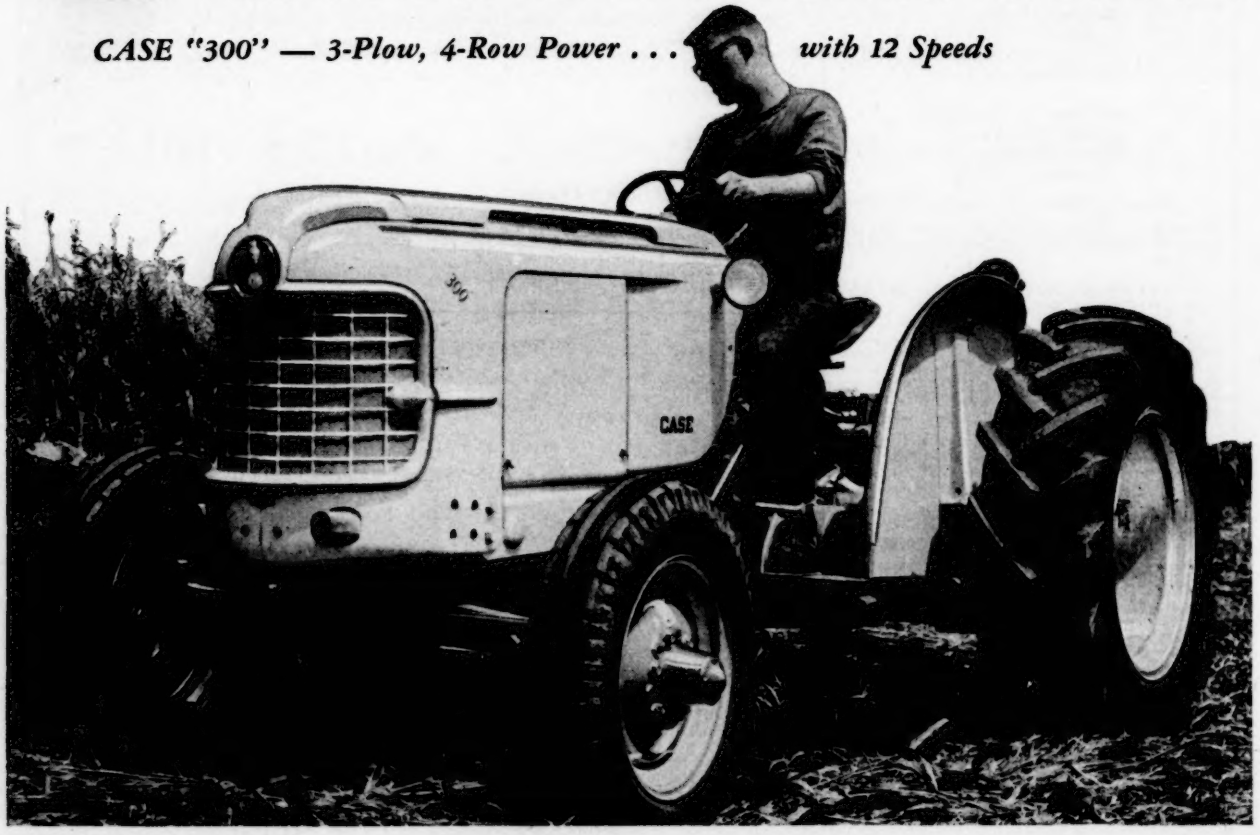
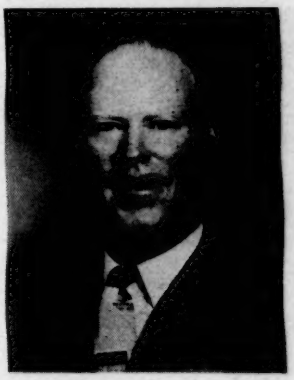


Principles of Crop Rotation

B. R. BERTRAMSON



B. R. Bertramson

True conservation theory should include the idea of full "use without abuse" for the resources involved. Many crop rotations save the soil but fail to permit fullest use of the land. Results of comparatively recent research point the way to shorter rotations and harder cropping without slighting conservation.

Briefly, here's crop rotation—past, present and future—as the author sees it.

"GOOD CROP ROTATIONS provide for systematic cropping of the land in a way that will stabilize the soil and maintain or improve fertility, increase yields, and improve the nutrient value of crops"(1). Big news of the 1730's in England's agriculture was Lauren Townshend's introduction of a new scheme of crop rotation. The scheme included wheat, turnips, barley, and alfalfa or beans and was known as the "Norfolk rotation." Under this system, the average per acre yield of wheat in England was raised from about 8 bushels to about 20 bushels by 1840.

Rotation Theories Pass in Review

Avid agriculturists argue rotations and religion with equal fervor. Let me review briefly some of the theories from the early to the modern that have had a bearing upon the acceptance of crop rotations.

The Fallow Theory. Crops grown on soils previously cultivated and uncropped or left to grow weeds for several years yield better than those grown continuously on the same soils. Crop production was considered fatiguing so soils needed a rest. For the most part, the practice of resting the soil was a partial answer to a soil fertility problem—later solved by modern soil science and fertilizer technology.

The Toxin Theory. According to this theory, crops produce toxin which causes poor growth in following crops. For instance, cane or sorghums have been considered to be "hard on the soil," since crops following them grew poorly. Modern theories have explained this on the basis of nitrogen tie-up and, where moisture is a limiting factor, on the greater depletion of moisture by sorghum crops than by some others.

B. R. Bertramson, a member of the SCSA, is chairman of the Department of Agronomy, State College of Washington, Pullman, Washington.

Sanitation Theory. When crops are rotated, they seem to escape some diseases which plague crops in non-rotated fields. For example, continuous growing of potatoes on an area results in serious losses from scab. Continuous growing of corn increases smut damage. This practice augurs well for the scheme of crop rotations.

The Pest Theory. Some crops seem to be associated with certain weeds, insects and rodents. For instance, oats are infested with wild oats, mustards, and other spring annuals as weeds. Pastures are contaminated with some of the perennial weeds, such as Canadian thistle. Winter wheat is infested with gromwell, tarweed, cheatgrass (downy brome) and other fall annuals. Rodents seem to prosper in perennial crops, such as pastures, alfalfa fields, etc. Wireworms thrive best in pastures. The alternation of crops tends to break up the happy homes of these pests, and, therefore, results in better yields and less nuisance.

Conservation Theory. In conservation, we need to think of "use without abuse." We are interested in the *greatest* sustained production, which means that we need to look carefully at the loss of topsoil.

A crop rotation including perennial forages permits a sequence of crops which leaves the soil exposed for the shortest possible time. This reduces the erosion hazard.

Several years ago, the Soil Conservation Service and the Agronomy Department at Purdue University worked out a system of rotations for Indiana conditions that had a very practical slant. They classified the soils according to degrees of inherent erosion hazard. For instance, the steeper the slope the greater is the erosion hazard. Likewise, the finer the soil texture, the greater the erosion hazard.

The formula for this classification was quite empirical; yet seasoned with practical experience, it worked fairly

well. The rule in adapting a rotation, then, was: "The greater the erosion hazard, the more years of a rotation should be devoted to a perennial forage crop."

This recognizes the necessity for a compromise between exploitation and conservation. In this way the maximum profit over a period of 20 to 30 years conforms fairly well with a good system of rotation employing the forage crops. While this system served well for livestock producers, cash crop farmers did not readily accept it.

From the theories discussed, we can see the following general reasons for rotating crops:

1. Crop rotations provide a definite area for each crop. This introduces orderliness into the method of crop sequences.
2. Alternating crops with different root systems and different growth habits permits us to make the best use of soil fertility and water resources. Crops have different depths of root systems and different growth habits. Some make greater demands on the fertility of the soil than others.
3. A rotation that includes grasses and legumes helps to maintain the soil organic matter. Where legumes are used, they add nitrogen ranging from negligible amounts to surpluses beyond the needs of the legume. But in numerous instances today, it is cheaper to buy the nitrogen fertilizers than to produce them in legume crops.
4. Grasses and forage legumes in the rotation help to restore the physical condition of the soil. Forage crops prevent erosion during the time the land is in these perennial crops and make the land more resistant to erosion for some time following these sod crops. Deep-rooted legumes help open up the subsoil for better aeration and for faster, deeper water penetration. Likewise, the use of rotations helps to prevent leaching by utilizing the nutrients during the time when there is a downward movement of water.

Except when nitrogen is the only limiting factor, crop rotations are not a substitute for fertilizers. Crops remove fertility regardless of their sequence unless all of the crop is returned to the soil. Hence, the maximum benefits can be derived only from a good sytsem of crop rotation supplemented by an adequate fertilizer program. Fertilizer, in general, is a supplement to good crop rotation, not a substitute for it.

To exploit the benefits of a rotation, it is necessary to give some thought to the order of crops in the rotation. In general, long-growing-season crops should be followed by short-growing-season crops. It is desirable to alternate deep- and shallow-rooted crops. It is desirable to alternate crops which furnish large amounts of crop residues with those which furnish scant residues and favor the rapid decomposition of organic matter. Green manure crops in the rotation may increase the availability of soil phosphorus and potassium. It is desirable to arrange the crops in sequence to obtain the greatest returns from the soil.

It is sometimes desirable to take into account the time interval between crops so that sufficient time is permitted for the accumulation of available nutrients for the next crop and for adequate seedbed preparation. For instance, plowing under a grass sod crop or a straw crop will result in considerable tie-up of nitrogen. Nowadays, we can correct this by supplementing the nutrients of the soil with fertilizers.

If too long a time interval between crops is permitted under fallow conditions, we have excessive leaching and erosion. Where weeds are permitted to grow on uncropped land, fertility and water may be wasted.

Controversies over rotations arise because the factors affecting rotations are constantly changing. Let us take a look at some of these factors.

Advances in Technology

I suspect many of the benefits claimed for rotations in the era before processed fertilizers may have resulted from the nitrogen fixed by the legume in the rotation. Thirty-year crop studies at Purdue University showed that the continuous corn had declined to a yield of about 50 bushels per acre. One would hardly recognize the crop on this plot in the 31st year. It had received 160 pounds of nitrogen to the acre and yielded about 120 bushels of corn. Obviously, the limiting factor in the production of corn under a system of continuous corn on that level was nitrogen. In rotation this was provided by the legume (*2*).

Continuous wheat at the Rothamsted Experiment Station for over 100 years yielded as well as the wheat in the rotation provided the continuous wheat was adequately fertilized. The average from either treatment was about 24 bushels per acre. Combining the rotation and the fertilizer treatments, however, gave a yield of over 32 bushels per acre—another 33% increase in yield. After 34 years of continuous wheat with adequate nitrogen at Pullman, Washington, yields compared favorably with wheat after fallow adequately fertilized with nitrogen.

Modern machines overcome some of the old problems that were best handled by rotations. New machines can harvest a crop quickly, thereby permitting early preparation of the land for the next crop. New machines permit timely completion of crucial operations, handle crop residues, improve the tilth of the soil, and prepare the seedbed more effectively than did the old horse-drawn machines of a few decades ago.

Horsepower to do the job is no longer a limiting factor. In 1910 more than 20 million horses and mules were used to till our soils. Today, the figure is less than one million.

Rotations must be fitted to soil type and farm operation. Fred Hazen, SCS, surveying soil on F. N. Johnston farm, Comus, Maryland.

Modern machines make it possible for farmers to handle both crops and livestock more efficiently.

Horses have been replaced by 4 million tractors doing the job better and faster.

Even the passing of the horse introduced another factor in our concept of rotations. We no longer need the many acres of pasture and the many acres of oats and hay to keep these hay-burners going. (This is in part compensated for by the greater demands of our growing population for meat and dairy products.) The manure by-product from this original source of horse power is no longer available, hence the need for added crop residues and fertilizers is greater.

New insecticides have made it possible to control the pests in a continuous crop quite well under some circumstances. The question remains whether it is cheaper to effect this control than it is to avoid the pests through a rotation. Whichever method of control nets the farmer the greater income in the long run is the one that will be accepted.

Selective herbicides have made it possible in some instances to grow the same crop continuously year after year with no particular weed problem. Again the economics of a rotation of crops versus a single cash crop with herbicides will determine which the farmer will follow in the long run.

Rodent control is receiving the attention of specialists with their new and mysterious chemicals. One of the most pressing problems of farmers in some of the irrigated areas of Washington is the control of pocket gophers. It appears there are still challenging problems for the biologists in the control of some of these animals. Also, it is well known by farmers that rotations are not an effective control of these pests in many instances.

Cheaper fertilizers in greater supply have decreased some of the dominant advantage that legumes earlier imparted to the rotation. We have also come to recognize that the growing of good crops, whether they be legume or others, makes large demands on the fertility of the soil. Here, expressed in dollars, is the value of plant nutrients removed from soil per acre by various crops (3):

Corn (60 bu./acre)	$13.60
Soybeans (20 bu./acre)	17.00
Alfalfa (4 tons/acre)	51.30

While the legumes do return some nitrogen to the soil, or at least provide their major nitrogen needs, they are in general heavy feeders on potash and phosphorus (3). Where the farmer finds it profitable to deviate from a rotation, whose principal advantage is providing the nitrogen to one in which he is using nitrogen fertilizer, the change to the simpler rotation is inevitable. This trend is illustrated in the increased production of synthetic nitrogen fertilizers: 1930, 300,000 tons; 1954, 1,800,000 tons—a six-fold increase in 24 years.

New crops continue to come into the picture. For instance, in the 1930's wheat had been the dominant cereal crop in the Great Plains area. But corn was grown extensively in this natural wheat area as the farmers began to shift from wheat production toward livestock. Now in these areas the new sorghums are coming in to take the place of some of the surplus acres of wheat. In the Midwest, soybeans have rapidly increased in popularity during the last two or three decades. Presently, farmers in the West and the Pacific Northwest are looking at safflower as a possible alternative crop to take some of the acres presently devoted to wheat. Obviously, these new crops place new emphasis and requirements on the need for rotations.

Government Regulations

Government farm programs have a dominant effect upon the rotation system as it is actually practiced by

farmers. Unfortunately, the program of acreage control and subsidies has often discouraged rather than encouraged a good system of crop rotation.

For instance, in the Great Plains the scheme has been two years of wheat followed by one year summer fallow. With the acreage limitation of the last two decades the pattern was shifted to one year of wheat and one year of summer fallow.

Acreage restrictions have resulted in a shift from annual cropping in areas of the Pacific Northwest well adapted to it. As a result, erosion has become more serious with the more extensive use of summer fallowing. Failure to give adequate credit for legumes in a rotation when computing a wheat base has encouraged many farmers to avoid a rotation with legumes. They feared loss of their acreage base for wheat, the crop that brought in the cash.

Weather and Weather Cycles

Weather and weather cycles also have a dominant effect upon the outlook of farmers with regard to rotations—particularly in areas where droughts and other weather hazards occur periodically. For example, in the Pacific Northwest a great deal of interest was manifested in annual cropping in the lower rainfall areas during the recent very favorable years when moisture was adequate. The added nitrogen needs of the crop were satisfied by fertilizer. It was indeed a profitable practice.

Last year's dry weather resulted in crop failures under annual cropping in the limited rainfall area of Washington. During the more favorable portion of the weather cycle, we are prone to adopt cropping practices which court disaster under the full impact of weather hazards.

What Does Research Show?

Just about everything I have said previously can be proved or disproved by the research work on rotations, depending upon how the rotations were set up and what they were designed to demonstrate or prove. One must bear in mind that rotations require several years to complete a cycle. In order to determine the cumulative effects, one has to study several cycles. A review of the literature reveals rotation studies extending anywhere from the classical ones of Rothamsted of over 100 years down to such newcomers as 30-year rotations. Some of these have provided us with a great deal of useful information. I have referred to some of this information already.

However, scarcely any of these were developed prior to the time of our newer concepts on field plot technique and use of statistics. Few, if any, of these had adequate replications and none of them had all the requirements for the application of our latest techniques and statistics in order to get reliable answers. Factors of soil variability were not appreciated in the setting up of many of these experiments. Present concepts of soil fertility and the benefits from extensive use of fertilizer were unknown. Modern field plot techniques were little understood and consequently neglected at that time. I have indicated some of the trends and technologies that have changed our thinking through the years. These also play havoc with the long-range experiments. As a result, many of the answers which were finally obtained are no longer applicable because new technologies, new crops, and entirely new situations are facing the farmers today.

New rotations set up within the last decade following the dictates of good field plot technique should give useful and reliable information. Admittedly, a portion of this may face obsolescence as the decades roll by and new technologies begin to appear.

In looking back over the various reasons I have cited for rotations and particularly for the use of grasses and legumes in the rotation, one reason stands out unchallenged—that of improving the soil structure and reducing erosion to a negligible factor.

With the demands for more livestock products in our higher standard of living, the prospect for more forage crops in the rotations seems good. Likewise, erosion following and during the growth of other crops in the location can probably be controlled through improved machinery, and fertilizer use.

Advances in science have shown us what is wrong with some of our old experiments in the rotation. But they have not permitted us to evaluate accurately the improvements in soil structure and physical conditions we think forage crops impart to the soil when used in rotation. Our methods of soil structure evaluation are indeed crude and inadequate. Our aggregate analysis methods are much too severe. They might be compared to the use of a sledge hammer in determining the relative strength of egg shells.

Advocates of short rotations (leys) including forages extol the cumulative benefits from this system. Work the soil hard! Keep it covered, fertilize it adequately, and keep the biological stress high. With several rounds of the rotations, the advantages of all these intensive practices continue to increase. I fully subscribe to this theory. I trust that modern rotation experiments will provide us with factual quantitative proof in its support.

LITERATURE CITED

1. Uhland, R. E. *Jour. Soil and Water Conservation*, Vol. 4, p. 146-152. 1949.
2. Peterson, J. B. *Jour. Soil and Water Conservation*, Vol. 10, p. 281-285. 1955.
3. *Fertilizer Review*, P. 10, January, 1950.

William West, Early Soil Conservationist

PAUL TABOR

Wide awake farmers and ranchers were among the first to recognize the need for conserving the soils of this country. This article tells part of the "on the farm" story of one of these early pioneers. Some of the problems and solutions were much the same as those of more recent years.

WILLIAM WEST did a spectacular job of soil conservation farming from 1768 to 1808. He was a cooper, but left this occupation when he was forty years old and bought a run-down farm in Delaware County, Pennsylvania. He removed the old, decayed fences, briers and hedge rows, and constructed good fences. The development of a satisfactory conservation plan followed.

West's neighbors grew corn and wheat, and allowed their few poor cattle to graze the stubble and browse "upon young twigs in the woods to the certain destruction of the growing timber." How the conservation plan was evolved and put in practice is related by Dr. James Mease in Vol. 2, *Memoirs of the Philadelphia Society for Promoting Agriculture* (1811):

"He (West) did not pretend to any knowledge in farming; but what he was and learned were sufficient to convince him that practices which neither enriched the farmer nor the land could not be the most eligible, and he therefore determined not to adopt them, and as he could derive no information from his neighbors, he read what books he could procure on farming, and for the rest he depended upon his own judgment. At the day alluded to, the science of agriculture was at a low ebb in every part of the European and American world: the useful spirit for diffusing the information by means of books was not excited in this country, and even in Europe, scarcely any works of much note had appeared on agriculture, except those of Du Hamel, De Lisle and Tull. The merit of Mr. West was therefore the greater because without the numerous helps which the modern farmer may have recourse to, derived from the works of these who have detailed the result of their experience, or from the good examples of their neighbors, he ventured to alter a bad system, and to establish a new one which experience of near half a century in this country has shown to be correct, and which added to the pecuniary resources and agricultural reputation of our State.

"The chief part of the cultivated land in Pennsylvania was in a course of tillage, and grain commanded but a small price. The business of grazing as already stated, was confined to a small district, and the inquiries he made satisfied him as to the superior profit arising therefrom, when compared to tillage. From this circumstance, therefore, as well as from a partiality for that pleasing branch of husbandry, he resolved as soon as circumstances would permit to lay down his land to grass.—What an undertaking at that time! and how was this to be accomplished? the introduction of red clover had taken place only a few years before, and, with the exception of a few districts, was confined to the vicinity of Philadelphia; for prejudice, the great enemy to all improvements, had opposed its progress among the cultivators of soil. The great advantage however of this valuable grass, derived from the immense burthen which it produced, were soon seen by Mr. West, and he determined to avail himself of them. Its fertilizing effects were the result of subsequent experience, the knowledge of which from recent and partial use of the plant was yet to be acquired. Clover was therefore sown, and his fields soon bloomed with the novel exotic, affording him treble the quantity of hay that had ever been known to grow in the vicinity upon the same quantity of ground. But clover, valuable as it proved to him and still is, he knew required to be renewed, and a permanent pasture was the object he aimed at, for he held it a principle that every country was blessed by a native permanent pasture grass. How therefore was this to be obtained? It occurred to him that a visit to the peninsula, where native grasses abounded, and an examination of the soil on which they grew might teach him something on the subject. He there saw that the whole soil was alluvial, and of course very rich, that luxuriant natural grass clothed the fields, and that the only manuring which they obtained consisted of the droppings of the cattle; here, then, were the principles upon which the improvement was to be grounded. Manure was applied as equally as possible to the surface of a rich bottom. Philosophically concluding that like causes must produce like effects, he determined to imitate the practice, and the result proved the accuracy of his deduction. The first object therefore to be attended to was to bring his soil, if possible, to the

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desirable state of fertility of the alluvial district, and this he knew could only be accomplished by the accumulation of manure. How therefore was this great desideratum to be obtained, and how increased? It was clear that the wandering of the cattle over the fields and roads or in the woods could not add to the stock of this great requisite: for in the one case it would be lessened in quantity, and diminished in quality by the action of the elements upon it; and in the other, it would be totally lost. He therefore confined his cattle to the barn yard during the winter, and to increase the quantity of manure, he, in the first instance, plentifully strewed the yard with leaves from the woods, while the scanty crop of straw, corn blades and corn stalks, which his first course (planting) yielded, assisted in supplying food.

"The sites of the old fences he had removed, the earth under the wild hedge rows which he had previously grubbed, were ploughed up, and together with that taken from the ditches he dug or cleaned out, were formed into composts containing a large proportion of lime: while every species of offal and vegetable matter about the dwelling house, and innumerable weeds while yet unripe, were added to the contents of the barn yard. He provided against drought by leading a spring from a considerable distance along his high lands, so as to irrigate at pleasure some of his largest fields. The precious water from the barn yard, which even to this day is either entirely lost, or permitted by most farmers to run off in wasteful profusion over a particular field, was confined by the construction of the yard, and forced to increase the riches of the fresh materials which were continually in progress to the fertilizing heap. To all his grass grounds, previously cleansed of perennial weeds by follow crops, he applied a compost manure early in the spring, always observing to accommodate it to the nature of the soil. He had the satisfaction to see the complete success of the practice. For as the artificial grasses (clovers and other legumes) declined, the permanent native green grass (Kentucky blue grass) took their place, and only required a repetition of the practice, which caused its appearance, to insure its continuance; and for many years he exhibited the only instance in the county of an intire sward of green grass upon an upland farm, and of fields which had not been disturbed by a plough for upwards of thirty years . . . In the short space of three years his supply of provender was so great as to enable him to sell hay to a farmer who possessed a much larger tract of land than his own, and who had indulged himself most in objections upon 'the town-man's farming.' The people of the vicinity saw with astonishment, field after field covered with heavy pasture, which formerly were distinguished by the great supply to the young people of fine blackberries . . .

"We are too apt to estimate the value of improvements, in a degree disproportionate to their value, when the theory that explains their success or the practice of them has become familiar to us. We wonder that what is so easily accomplished, and is so simple, should have been so long concealed from us, or have been so recently adopted, and this remark will apply with particular force to the present occasion. The practice of producing a fine sward upon upland farms, by the application of manure to the surface, now appears so simple that it strikes us with astonishment, that the thought did not occur to others at a more early period: but this wonder will cease when it is known that even to this day in many parts of the country, the benefit of it remains yet to be discovered . . .

"It was indicative of Mr. West's disposition to improve, and an evidence of his freedom from prejudice, that he at a very early period adopted the use of gypsum as a manure; conscious that he had much to learn, he was always on the search for information, and he no sooner heard of the beneficial effects, which had been experienced from that singular substance on some of the city lots, then he made further inquiry respecting it, and saw and heard enough to satisfy him as to its utility. Without therefore hesitating as many did, because he could not account for the theory of its operation, he resolved upon its use. The first season convinced him that it was a most important acquisition to the farmer and the experience of every subsequent year confirmed him in the opinion he at first had adopted . . .

"He was frequently importuned by his friends to give to the world a statement of the improvements he had effected and of his practice in general, but he as constantly declined to comply. His uniform answer was 'come and see, I can inform you more by conversation in a few hours, and a walk over the farm, than by writing volumes.' A visit to his farm was well repaid. The inquirer found always a hospitable reception, a pleasant companion, and saw every thing about the land bearing the strongest marks of industry, care and skill . . . He held it as a point of duty in every man who occupies land to endeavor as far as capable to keep it in an improving state, for the benefit of himself, his connections, the public, and posterity . . ."

USDA foresters expect requests for a billion more forest tree seedlings as a result of the conservation reserve portion of the soil bank program. To take care of this anticipated need, many of the present state tree nurseries are being expanded. And some new ones are being established.

Under provisions of the soil bank, technical help for tree planting is to be furnished through local branches of the state forestry offices.

Soil Moisture Measurements in Irrigating Sweet Corn

F. R. DREIBELBIS AND R. E. YOUKER

Research on irrigation in the humid parts of the United States is getting beyond the mechanical "how to" stage. Here, the authors present one year of data on irrigating sweet corn. This is another step along the way to finding out how much and when to apply irrigation water.

ONE OF THE IMPORTANT needs in irrigation work is an accurate inventory of the soil moisture conditions.

Such information can provide a basis for determining the proper time to irrigate and the amount of water that is necessary. Excessive applications not only waste water but are a factor in leaching many of the plant nutrients to lower levels where they are seldom available to plant roots. Also, unnecessary runoff and erosion may be caused by such excessive water. On the other hand, plants may suffer from lack of water unless water is added when the soil moisture reaches a critical point.

In an effort to solve some of these problems, fiberglas-gypsum blocks have been used to measure soil-water depletion at different increments of soil depth. Such measurements provide data for observing the role of the soil moisture reservoir in the hydrologic cycle and furnish also information of value for those interested more specifically in irrigation.

Previous Work

Previous data on this subject from this Station were presented by Harrold (2) in which extraction patterns of soil moisture on corn land were given. Dreibelbis and Youker (1) also presented data on soil moisture distribution on corn plots in evaluating the quantitative needs of water for irrigation purposes on the Keene and Muskingum soils.

Weighing monolith lysimeters as reported by Harrold and Dreibelbis (3) furnish data on total soil moisture extraction by different crops by days, months, and seasons without irrigation. Extraction was not evaluated by soil depth, an important item in irrigation design and operation as well as in various other hydrologic determinations.

Experimental Procedure

In this experiment sweet corn was grown on three groups of plots of Muskingum silt loam having a slope of five percent. Each of the adjacent groups contained three plots, 14 by 6.2 feet in size, separated by a three-foot border. Two groups were irrigated by a sprinkler system while the third received no irrigation and was used as check plots. One group of the irrigated plots was mulched with manure and the other received no mulch. All nine plots received the same fertility treatment.

It was decided beforehand that the plots to be irrigated would be irrigated whenever the soil moisture content in the 0-14 inch soil depth reached the one-half available level. The choice of the one-half available level is arbitrary but is believed to be near the desirable level for irrigation.

Fiberglas-gypsum blocks, as described by Youker and Dreibelbis (5), were installed in triplicate in 1955 on each of the 9 plots to measure soil-water depletion at different increments of the soil depth. The blocks were placed to represent the 0-1, 1-4, 4-7, 7-10, 10-14, and 14-24 inch soil depths. A total of 9 replicates for each soil depth was used on both the irrigated plots and on the check plots. The data from the soil moisture blocks were expressed in inches of water for each soil depth. The method for calibrating and installing these blocks was previously described by Stackhouse and Youker (4).

Results

Soil moisture depletion was determined from moisture changes in the soil as determined by the fiberglas-gypsum blocks in the respective soil depths enumerated above. These data were summarized and are presented in Table 1 showing average daily depletion rates in the 0-7, 0-10, 0-12, 0-14, 0-18, and 0-24 inch soil layers.

For depth of 0-12 inches, soil-moisture values were obtained from the blocks representing the 0-1, 1-4, 4-7, and 7-10 inch depths plus the 10-14 inch depth block data applied to only the 10-12 inch depth. For example, if the 10-14 inch block indicated 20 percent moisture, the calculated moisture in this 4-inch depth would be 0.80 inch and that in the 10-12 inch depth would be 0.40 inch. Similar calculations are used to evaluate moisture in the 0-18 inch depth.

Six periods extending from June 17 to August 16, 1955, have been used for presenting the results. Average daily depletion rates for the entire period are also given.

First period (June 17-19)

Depletion of moisture in the topsoil (0-7 inches) can be

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Table 1. A summary of daily depletion rates on irrigated (J), irrigated mulch (K), and check (L) plots in sweet corn, 1955*

Date 1955	Average daily depletion rates in various soil layers (Expressed in inches of water)**																	
	Irrigated plots (J)						Irrigated mulch plots (K)***						Check plots (L)					
	0–7	0–10	0–12	0–14	0–18	0–24	0–7	0–10	0–12	0–14	0–18	0–24	0–7	0–10	0–12	0–14	0–18	0–24
6/17–19	0.09	0.13	0.15	0.16	0.18	0.19	0.09	0.11	0.14	0.17	0.19	0.23	0.09	0.12	0.17	0.21	0.24	0.28
6/20–29	.08	.08	.08	.08	.10	.10	.07	.07	.06	.06	.07	.08	.09	.09	.10	.12	.13	.15
6/30–7/13	.18	.17	.17	.16	.15	.14	.18	.17	.17	.16	.15	.14	.19	.18	.17	.16	.16	.14
7/14–24	.12	.15	.17	.19	.21	.26	.13	.15	.17	.19	.21	.25	.10	.12	.16	.19	.22	.28
	Irrigated July 25, 1.60 inches																	
7/25–8/1	.30	.29	.28	.28	.28	.29	.14	.15	.16	.17	.19	.21	.12	.14	.15	.16	.18	.20
	Irrigated August 3, 1.60 inches						**Irrigated August 3, 1.60 inches**											
8/2–16	.24	.24	.25	.25	.26	.26	.20	.19	.18	.18	.16	.14	.14	.13	.13	.13	.14	.15
6/17–8/16	.18	.18	.19	.19	.20	.21	.15	.15	.15	.16	.16	16	.13	.14	.15	.15	.17	.18

* Rainfall 7.17 inches, 6-17 to 8-16.
** Data from average of nine replicates.
*** Manure mulch applied June 21, 1955.

attributed to evapotranspiration. These depletion values are identical on all plots—0.09 inch per day.

As moisture in the subsoil below the 7-inch depth was above field capacity, the depletion values for the 0-10 inch and greater depths include both evapotranspiration and drainage.

Second period (June 20-29)

The manure-mulch was applied on June 21. Daily depletion rates on these plots were slightly lower than on the others. This was probably due to the effects of mulch in reducing evaporation rates.

Indications are that most of the depletion was from the 0-7 inch layer. For this period, the 0-7 inch layer may suffice as a criterion for determining irrigation needs.

Third period (June 30-July 13)

Rainfall of 2.72 inches resulted in some runoff from the check plots (L) and unmulched plots (J). Little, if any, runoff ocurred from the mulched plots (K). The depletion rates for this period averaged about the same on the three sets of plots. But at the end of the period there was 0.66 inch more water in the 0-14 inch layer of the mulched plots than in the unmulched irrigated (J) plots. It is likely that this increase was due to greater infiltration on the mulch plots. Apparently mulching had little effect in reducing evaporation rates in this instance, since the depletion rates were about the same on all the plots.

Average daily moisture depletion rates on all three sets of plots was greater in the 0-7 inch layer during the third period than in deeper increments of the soil profile. This may be due in part to drainage of moisture from the upper into the lower soil layers. But it may reflect also the effect of root concentrations in this upper layer.

It indicates that during this period, as in the second period, the soil moisture level in the 0-7 inch layer might serve as a criterion for determining irrigation needs.

Similar results were obtained the previous year on Keene silt loam (1).

Fourth Period (July 14-24)

By the end of this period, soil moisture on the irrigated (J) plots had reached the one-half available level, the arbitrarily chosen point for irrigation. The soil moisture level had not yet reached this point on the plot to which a manure mulch had been applied.

For this period, the 0-7 inch layer would not suffice for determining irrigation needs because there was additional depletion in the layers below the 0-7 inch depth. Since the soil moisture in the 14-24 inch depth was still above field capacity during most of this period, it appears the 0-14 inch depth would have been the proper one to use in determining irrigation needs.

Fifth period (July 25-August 1)

On July 25, 1.60 inches of water were applied to the irrigated (J) plots. A marked contrast in depletion rates was observed following this irrigation.

In the 0-7 inch layer the rates were 0.16 inch per day greater on the irrigated (J) plots than on the mulch plots not yet irrigated and 0.14 inch greater in the 0-10 inch soil layer. Differences of the same magnitude were noted between the irrigated and the check plots.

During the period immediately preceding irrigation, moisture extraction averaged 0.09 inch per day from the 12-24 inch layer on the irrigated (J) plots but amounted to only 0.01 inch per day after irrigation. Extraction rate values for the corresponding soil depth increment on the mulch plots (K), uninfluenced as yet by irrigation, were 0.08 and 0.05 inch for the respective periods. This suggests there was less moisture extracted from the 12-24 inch depth after irrigation as would be expected.

Sixth period (August 2-16)

Both sets of irrigated plots required irrigation on August 3 and each received an application of 1.60 inches of water. This together with 2.06 inches rainfall, brought the total to 3.66 inches for the period.

The daily depletion rates on the irrigated (J) plots

were higher than on the irrigated-mulch. Both were higher than on the check. The mulch apparently was effective in reducing evaporation. Soil moisture on the mulch (K) plots was 1.03 inches higher in the 0-14 inch layer (see Table 4) than on the (J) plots on August 17. The difference in depletion rates may also be partly attributed to the effect of mulch in preventing or reducing surface runoff.

Total period (June 17-August 16)

The average daily depletion rates for the total period of the observation were highest on the (J) plots which were irrigated twice and about the same on the other two groups of plots. In the latter, the rate was slightly higher in the 0-14 inch layer on the mulch (K) plots but in the 0-24 inch layer the check (L) plots showed the higher rate.

Consumptive Use

Total consumptive use of water was 12.59 inches from the irrigated unmulched plots; 9.88 inches from the mulch-irrigated (K) plots; and 11.23 inches from the check (L) plots. Of this total, 86, 92, and 71 percent, respectively, from the 0-7 inch soil layer. Consumptive use is shown by the various soil horizons in Table 2.

Table 2. Consumptive use of soil water from various soil layers by sweet corn, June 17 to August 16, 1955.

Soil layer inches	Irrigated (J)		Irrigated-manure mulch (K)		Check (L)	
	Total inches	Inch/inch*	Total inches	Inch/inch*	Total inches	Inch/inch*
0-7	10.89	1.56	9.07	1.30	7.92	1.13
7-10	.27	.09	.13	.04	.37	.12
10-12	.24	.12	.15	.08	.56	.28
12-14	.24	.12	.16	.08	.58	.29
14-18	.38	.10	.15	.04	.72	.18
18-24	.57	.10	.22	.04	1.08	.18
0-24	12.59	.52	9.88	.41	11.23	.47

*Inches water per inch of soil.

Water removal from the subsoil was appreciably greater on the check plots than on the irrigated plots. This is likely due to the depletion of moisture in the surface soil of the check plots and the deeper penetration of roots. Deeper penetration of roots on the check plots was confirmed by visual observations.

Total soil moisture in the 0-24 inch soil layer was less at the end of the growing season than at the beginning of each of the three sets of plots, the difference amounting to 2.25, 1.11 and 4.06 inches on the (J), (K), and (L) plots, respectively.

Rainfall Distribution

Data on rainfall distribution for June, July, and August 1955 are given in Table 3. Rainfall was below normal both for June and July while in August, it was above the 18-year average. All of the August rainfall occurred after the irrigation on August 3.

Table 3. Daily rain and irrigation, sweet corn plots (J) June, July, August 1955.

Date	Rain (inches)	Irrigation (inches)	Date	Rain (inches)	Irrigation (inches)
June 6	0.08	0	July 10	1.08	0
7	.07	0	14	.36	0
8	.27	0	16	.28	0
10	.19	0	18	T	0
11	.33	0	24	.04	0
12	.09	0	25	0	1.60
13	.01	0	27	.70	
20	.02	0	28	.27	
21	.24	0	Aug. 3	0	1.60
23	.48	0	4	T	0
25	T	0	7	1.12	0
30	.83	0	10	.09	0
July 1	.01	0	11	.18	0
2	.02	0	13	.57	0
3	.14	0	16	.10	0
6	.47	0	22	1.29	0
9	.17	0	—	—	—

June rainfall—2.61 in.; 18-year average 4.40 in.
July rainfall—3.54 in.; 18-year average 4.25 in.
August rainfall—3.35 in.; 18-year average 2.88 in.

Soil Moisture Distribution

Data on the soil moisture distribution of the three experimental plots are given in Table 4 for three selected dates in the 0-1, 1-4, 4-7, 7-10, and 10-14 inch soil layers.

On July 25, the moisture distribution on the irrigated (J) and check (L) plots was nearly the same. Since no irrigation had yet been applied this was to be expected. The moisture on the mulch plot, also unirrigated at this date, was definitely higher, reflecting the influence of mulch on moisture conservation.

The sharp contrast in moisture between the 4-7 inch and 7-10 inch depth is due to changes in the soil horizon, the subsoil retaining more moisture at the same tension than the topsoil.

On August 3, soil moisture on the (J) (irrigated once) plots and on the mulch (K) plots (as yet unirrigated) was nearly the same and both had practically reached the

Table 4. Soil moisture distribution on irrigated, irrigated-mulch, and on check plots in sweet corn for selected dates, 1955.

Plot	Treatment	Moisture (inch of water per inch of depth) in soil at depth of					Total moisture (inches)
		0-1"	1-4"	4-7"	7-10"	10-14"	0-14"
	July 25, 1955 (Before irrigation on J plots)						
J	Irrigated	0.13	0.13	0.14	0.23	0.26	2.67
K	Irrigated-mulch	.15	.19	.17	.26	.30	3.21
L	Check	.13	.15	.13	.21	.27	2.68
	August 3, 1955 (Before irrigation on J and K plots)						
J	Irrigated	.16	.16	.17	.24	.28	2.99
K	Irrigated-mulch	.14	.16	.16	.24	.27	2.90
L*	Check	.13	.14	.13	.18	.23	2.40
	August 4, 1955 (After irrigation on J and K plots)						
J	Irrigated	.29	.27	.25	.29	.41	4.36
K	Irrigated-mulch	.31	.33	.33	.36	.42	5.05
L	Check	.12	.12	.11	.18	.21	2.19
	August 17, 1955 (End of season)						
J	Irrigated	.17	.18	.16	.23	.25	2.88
K	Irrigated-mulch	.22	.27	.25	.27	.33	3.91
L	Check	.13	.16	.11	.20	.22	2.42

*Data for August 2; no data for August 3.

point of one-half available water. The check plots already were 0.4 inch below this level in the 0-14 inch layer.

Data for August 4 show the influence of irrigation the previous day on soil moisture distribution. On the (J) plots, soil moisture was just below field capacity in all layers except the 10-14 inch depth where it was above. On the irrigated-mulch (K) plots the moisture was slightly above field capacity in all layers and appreciably above this level in the 10-14 inch depth. The soil moisture distribution on these plots reflect the movement of water to lower levels.

On the check plots the moisture had not reached the wilting point but was only 0.3 inch per inch above this level in the topsoil. In the upper subsoil (7-10 inch layer) the soil moisture was still 0.06 inch above the wilting point. This was near the 30 percent available soil moisture level, while that in the topsoil was below the 20 percent available soil moisture level. *From these data it appears that low soil moisture exerts its influence on growth and yield before the wilting point is reached.*

Corn Yields and Consumptive Use

The data in Table 5 give comparative yields, height of plants and consumptive use of soil water for the period June 17 to August 16, 1955. Both the yields and height of plants were the greatest on the manure mulch (K) plots, while the consumptive use of water in the 0-24 inch depth was the lowest on these plots. This indicates that the manure mulch (K) plots, irrigated once in this experiment, gave the greatest economy in water use. *The beneficial effects of manure mulch thus apear not only to reduce runoff and erosion, but also to improve the water economy.*

Table 5. Data on yields, height, and consumptive use of water by plants on sweet corn plots, 1955.

Treatment	Yield per acre		Average height of plants*	Consumptive use**	
				Total 0-14 In. layer	Total 0-24 In. layer
	Ears	Weight			
	Number	Pounds	Inches	Inches	Inches
J. Irrigated	12,200	6,730	63.3	11.64	12.59
K. Irrigated-mulch	14,200	9,270	68.2	9.51	9.88
L. Check	6,670	3,600	56.2	9.43	11.23

* August 4, 1955.
** For period June 17 to August 16, 1955.

Quantity of Water to Add for Irrigation Purposes

The irrigation farmer needs to know what is the proper depth to use in irrigating farm crops. In the humid region it is likely this depth will range between 7 and 24 inches for soil profiles like those at the Coshocton Station. The data in Table 6 give some idea how much water to add to bring the soil moisture of Muskingum silt loam from one-half available up to field capacity. For example, in the 0-7 inch depth, 0.73 inch water would be required; in the 0-24 inch depth, 2.40 inches would be needed. At field capacity the moisture present in the 0-7 inch and 0-24 inch layers would amount to 2.03 and 7.30 inches, respectively. The Muskingum silt loam is rather widely distributed and is listed as number 6 in the Ohio drainage classification. The values in table 6 should apply reasonably well to all soils in the humid region in this classification.

Table 6. Soil moisture values for evaluating quantitative needs of water for irrigation purposes on the Muskingum silt loam. (Expressed in inches of water)

	Depth of soil layers					
	0-7"	0-10"	0-12"	0-14"	0-18"	0-24"
Field capacity*	2.03	2.96	3.58	4.20	5.44	7.30
Wilting point**	.56	.92	1.16	1.40	1.84	2.50
Available water	1.47	2.04	2.42	2.80	3.60	4.80
Irrigate at moisture content of***	1.30	1.94	2.37	2.80	3.64	4.90
Amount of irrigation to raise moisture content to field capacity****	.73	1.02	1.21	1.40	1.80	2.40

* As determined by the moisture equivalent.
** As determined at 15 atmospheres pressure.
*** One-half available level.
**** Approximately 0.1 inch water per inch of soil for any part of the 0-24 inch layer.

Data From Two Soil Types

The data in 1955 were obtained on the Muskingum silt loam, while data in 1954 (1) on sweet corn plots were obtained on the Keene silt loam. Results on these two soil types were similar. In both years the 0-7 inch depth would have been sufficient for irrigation purposes up to July 14. After that date, the 0-14 inch depth was the proper one to use. Since the growing season for sweet corn is shorter than for field corn, which is grown to maturity, the data obtained in this paper do not necessarily apply to field corn. However, the values presented in Table 6 showing amounts of water necessary to bring to field capacity, obviously, would apply regardless of the crop grown.

LITERATURE CITED

1. Dreibelbis, F. R. and Youker, R. E. 1955. *Soil moisture distribution on irrigated corn plots.* Soil Sci. Soc. Amer. Proc. 20.
2. Harrold, Lloyd L. 1954. *Available moisture for crops.* Agr. Eng. 35: 99-101.
3. Harrold, L. L. and Dreibelbis, F. R. 1951. *Agricultural hydrology as evaluated by monolith lysimeters* U.S.D.A. Technical Bulletin No. 1050.
4. Stackhouse, John M. and Youker, R. E. 1954. *Evaluation of the accuracy of fiberglas gypsum blocks for measuring soil moisture changes.* Agron. Jour. 46: 405-407.
5. Youker, R. E. and Dreibelbis, F. R. 1951. *An improved soil moisture measuring unit for hydrologic studies.* Trans. Amer. Geophys. Union, 32:447-449.

Conservation Practices in Northeast Oklahoma

MILTON T. GAULT AND MYRON A. HURD

Drive to Tulsa, Oklahoma, for the 11th annual meeting of the Soil Conservation Society of America. Then you'll have a chance to see some of the soil saving practices as described in this article.

TWENTY-EIGHT reportable soil conservation practices are listed for northeast Oklahoma. A few of the practices are described here as they apply in this area.

Improving pastures, of course, is one of the major soil saving practices in a grazing area. Of course, pasture improvement takes several forms.

Bermudagrass Is Popular

Bermudagrass (common, midland, coastal and Greenfield) is the number one pasture grass for land being devoted permanently to tame pasture use.

Annual lespedezas, hairy vetch and hop, white, sweet, alsike and other clovers in minor frequency, are usually planted over the Bermudagrass. Sod drills are used in established stands of Bermudagrass to fertilize and stir the ground and to seed vetch, clovers, and small grains for temporary supplemental winter grazing.

Because of the tenacity of Bermudagrass, pastures can be plowed and cultivated a year or two, then seeded in lespedeza, vetch or clovers and returned to pasture. Both the pasture and crops are better as a rule with this management.

Our best Bermudagrass pastures carry two cows and calves per acre all year long. But a cow and calf per three acres is nearer the average at present. That averages about 150 pounds of beef per acre. This can be increased greatly by better management practices, including more liberal use of commercial fertilizers.

Bermudagrass has ability to make quick recovery from heat, freezes, floods, drouth, trampling, fire and other abuses. It is ready to graze here starting in April. Cattle often prefer the dead Bermudagrass in the pasture to prairie hay during the winter.

Farmers resisted Bermudagrass at first because of its tendency to invade gardens, flower beds and other sites. But its obvious advantages soon overcame all resistance.

Other Grasses May Be Used

Other tame grasses used are African weeping lovegrass tall fescues, Southland and Achenback bromes, downy and Japanese annual bromes, perennial and annual ryegrass, and red top grass.

Weeping lovegrass is well adapted to most sites within this area. But it generally gives way to sand lovegrass in the central and western portion of Oklahoma. It is less palatable than the sand variety. However, it is easier to establish and manage in that section. For best grazing it should be kept rather short and overseeded with legumes of which sericea lespedeza appears to be best suited so far.

Tall fescues are adapted to most deep, productive sites. It does well on sites normally too wet or too frequently flooded for alfalfa. Long periods of below normal rainfall make proper management necessary. Ladino or alsike clover is generally grown in combination with fescue to improve the quality of the grazing forage.

Southland and Achenback bromes are especially selected to withstand our summer drouths, if rested during the summer. Southland brome is a new grass which is praised highly by Oklahoma A & M College for fertile, well drained soils suitable for alfalfa. It needs further trial plantings before widespread adoption.

Red top is grown to a very limited extent on selected sites. Warm season or cool season companion legumes and grasses are generally grown with the red top, depending on how and when it is to be harvested.

The annual bromes volunteer regularly but are seldom seeded intentionally. However, they, with a little winter

Bermudagrass is used to improve many Oklahoma pastures. Planted with lespedeza and clover, it can carry two cows per acre in good years. Lonnie Blair farm, Wagoner, Oklahoma.

Milton T. Gault is area conservationist and Myron A. Hurd is work unit conservationist, Soil Conservation Service, Claremore, Oklahoma.

barley and wild rye, afford a great deal of early cool season grazing in this climate.

Legumes Fit Tame Pastures

Tame legumes are used for pasture and hay, or in rotation for soil improvement. Alfalfa and sericea lespedeza are the most used perennials. Sweet clover is the biennial. Hairy vetch, hop clovers and lespedezas (Korean and Kobe) are the principal annuals.

Alfalfa is adapted to well drained, infrequently flooded bottom land and the deep, productive uplands. Applications of lime and fertilizer are generally required for maximum production and continued stand. Longevity is from two to six years on upland and up to fifteen years or more on bottomlands. Insects, low fertility, and drouths cause the greatest stand loss.

Sericea lespedeza continues to gain in popularity and prove its rightful place in the permanent agriculture of this area. It rates high in ease of establishment, ability to resist heat, drouth, flood, freeze, fire, shade and insects.

Some, who have not yet learned to properly use this plant, too hastily criticize its palatability. This is mainly because it has been allowed to approach maturity before grazing. At this point the fiber and tanic acid contents are at the highest point.

It is best adapted to the soils of the Ozark country (cherty limestones) but can be expected to produce economically on practically all soils of the eastern half of Oklahoma.

Hairy vetch, (planted in August or September with small grains), annual lespedezas (principally Korean and Kobe), and sweet clover (planted in February or March with small grain), are the principal annual and biennial legumes for soil improvement.

Vetch and sweet clover are generally used for temporary supplemental grazing during the cool season, with livestock removed in ample time to permit full recovery of growth to turn back to the soil improvement. In some cases, vetch and sweet clover seed is harvested. Korean lespedeza is more often used for hay than for soil improvement or seed productions, and may produce up to three tons of highly palatable hay per acre on deep productive soils during years of normal or above normal rainfall.

Alsike, White Dutch and Ladino clover are generally used in pastures with such cool season base grasses as the tall fescues, rye grasses and bromes. Hop clovers and lespedezas (Korean and Kobe) are generally planted with Bermudagrass as the base grass for warm season grazing.

The legumes in the pasture mixture not only furnish livestock grazing, but improve the palatability and growth of the base grasses. Many cooperators cut ensilage or hay from surplus forage produced on highly productive pastures.

Red and crimson clovers, orchardgrass, bluegrass, and Dallisgrass are used to a very limited extent in the extreme east and northeast portion of this territory. Caucasian bluestem, Kings Ranch bluestem and blue panicum are being grown to a minor extent and show promise of occupying a more important spot in the grazing program.

Emphasis has been placed on conserving crop residues and working litter into or near the surface of the soils. This is a great advance from the days when burning of fields and pastures was a common practice.

Grazing Management

"Proper use"—is a management practice, applicable to native bluestem grasses only. The stocking rate recommended for range lands varies according to site and condition class. To obtain such use it is often necessary to practice deferred grazing, rotation grazing and uniform stocking rates.

The objective of range management is to stock at the maximum rate possible without causing deterioration of range condition. The stocking rate may vary from four or five acres per steer for four to six months to forty or more acres per cow yearlong. The range rule of *"Take half—leave half"* of the grass is generally accepted.

The practice of seeding annual legumes or tame grasses, of sodding Bermudagrass and of liming and fertilizing native grasses is not recognized as good economical range management techniques in this territory. Climax grasses when maintained in top condition, do not tolerate the weaker, tame plants. Fertilizing, liming and introduction of tame plants invite overgrazing or uneven grazing. Uniform grazing is the objective in good range management.

Erosion Control Practices

Diversion terraces, terraces, sod waterways, contour farming and strip cropping—these practices are used to some extent here as in most districts in the United States. Perhaps more diversion terraces are used to turn hillside water away from cropland than in many areas. Native or tame pastures and meadows are usually available to receive terrace water without the necessity of constructing and sodding outlet channels or waterways. Some of the districts in this territory have as much as 75 percent of the total land area in grasses.

There has been more resistance to contour farming and strip cropping with terraces than to most practices. This is largely because only a small part of the land is used for row crops.

Land Clearing and Brush Control

Dozers with cutting blades, saws of various kinds and chemicals have been used with varying degrees of success. The dozer with cutting blades, and rakes followed by plows do the most complete and permanent job at a cost

You can see this on the tour during the SCSA annual meeting in Tulsa, Oklahoma. This site is on the Double Creek Upstream Flood Prevention Pilot Watershed.

varying from $10 to $80 per acre, depending on density and size of brush or timber.

Some airplane spraying has been done but portable truck sprays are more often used.

Ponds and Reservoirs

Pond and reservoir construction for livestock water has been an important practice, especially since the drouth years beginning in 1952. During the early years pond dams averaged 856 yards. Today they average 1,500 or 2,000 yards, showing increased recognition of the importance of an ample supply of water.

Many of the ponds have been stocked with bass, bream and channel catfish and managed for better fishing.

Drainage Systems

Drainage systems have been designed and established on wet creek and river bottom lands on many farms. Mostly they are wide V-shaped main and lateral ditches with sufficient design and capacity to remove excess water within twenty-four hours. Such systems have converted wet wastelands into highly productive fields, permitting owners to retire less productive upland fields to pasture.

Irrigation

Irrigation is the newest, most talked about practice in Oklahoma today. Soil conservation districts provide the engineering for establishment of irrigation systems where practical and economically feasible as part of a farm unit.

While Rogers County Soil Conservation District in northeast Oklahoma has the largest graded border irrigation system in Oklahoma, the overhead sprinkler type of irrigation is almost universally used. The SCS technicians assist cooperators with design and establishment of a system which will operate at maximum efficiency according to desired frequency and time schedules.

Irrigation water is secured from rivers, creeks, lakes, wells and reservoirs. It requires from two to three acre feet of water annually for each acre to be irrigated.

These are only a few of the listed twenty-eight reportable soil conservation practices in northeast Oklahoma. They were selected to give the scope of soil conservation activities.

Many of them will be seen as you drive along the highways in Oklahoma. Real progress has been made in the field on the various farms and a record of it is maintained in each district cooperator's file.

Warren McCarty, SCS, and Clair Fickett, manager of Greenhill Farm near Mingo, Oklahoma, examine oats produced on newly cleared land. These two men will help direct the tour to be held during the annual meeting of SCSA in Tulsa, Oklahoma.

A Better Conservation Program Through Radio

FLOYD E. CARLSON

The conservation sales story must be told again and again. No single "sales pitch" is going to do the job. Though television has shifted the pattern of radio listening, people of this country own more radios than ever before. Here are some tips on how to use this potent tool for selling conservation.

WHEN THE COLLEGE of Forestry put on its first television program on May 22, 1946, there were just seven television stations on the air. In less than ten years the number has increased to 457 television stations.

As this great colossus of information, entertainment, and selling unlimbered its potential energy to span the continent, the realm of radio seemed to shrink back from what seemed an inevitable doom. Advertisers, essentially concerned with selling, loaded increasing amounts of their budget on this glamorous giant, while radio began to take up several hitches in its belt as its share of the advertiser's budget was sliced thinner and thinner with the forecast of austerity for the long future.

One of the consequences of the radio-television conflict was that the radio set in the living quarters made way for that magical box, the television receiver; but, here is the point. Radio moved, not out, but to other places in the house—to the kitchen, to the bedroom, yes even to the bathroom, and to the car in the garage, and out into the barn. Taking up and giving more place to news, music, sports, and special reports with less drama and network commercial time, radio is today fitting into its niche, not as broad a niche as before the advent of television, but nevertheless a medium that anticipates a long period of service.

Radio Is Still Important

With prosperity pushing sales, there has been a strong market in the past few years for radio receivers, both portable and otherwise. So while radio no longer has the clear grasp on immediate mass communication that it had, it is a vital factor in the selling of ideas, broadcasting news, and on both counts a logical medium for use of the conservationist.

For a moment, let's look at radio and television as the advertiser sees them. Taking the advertising money laid out for both radio and television together, and then separately for each, here are the figures with estimates for 1955:

Year	*Radio & Television*	*Television*	*Radio*
1952	452 million	270	182
1953	564 million	272	191
1954	678 million	503	174
1955 (*Est.*)	715 million (*Est.*)	540 (*Est.*)	175 (*Est.*)

Measured by the discriminating rule of the advertiser, the relative value of television and radio today is roughly three to one. *So if the television opportunity comes to you, by all means use it, and if for a 15 minute program you don't invest at least three times as much in time and effort as you would for a radio program, you probably aren't doing justice to your opportunity and the value of the medium.*

But there is another side to the radio and television picture that needs to be brought into focus. That has to do with the relative number of radio and television stations. Currently, there are on the air throughout the country 457 television stations as mentioned above.

Figure 1. "They're alive!" At the Radio-Television Center of Syracuse University, an Empire State F.M. School of the Air program gets off to a good start with a panel of grade school students learning how earthworms incorporate leaves into the soil. To maintain spontaneity, Mr. Carlson used a script outline of questions and less than a half hour of rehearsal just before airtime.

This paper by Floyd E. Carlson was presented at the Annual Winter Meeting of the Empire State Chapter of the SCSA at Ithaca, New York, February 4, 1956. *Mr. Carlson is associate professor of Forest Extension at the State University, College of Forestry, Syracuse, New York, where he is in charge of radio and television.*

Figure 2. The cooperative approach to program building keeps broadcasts fresh and on the beam. Here at the State University College of Forestry in Syracuse, New York, the 3rd Planning Conference of the F.M. School broadcasts on "Our Natural Resources" brings together teachers, school administrators, and natural resource authorities including from left: Frank A. Connolly, Information Specialist, Eastern Region, Forest Service; Irving B. Stafford, State Conservationist, New York, Soil Conservation Service; Dr. John D. Bulger, formerly Division of Education, New York State Conservation Department, presently with National Wildlife Federation; and Miss Grace Boulton, Producer "Science Adventures," on School of the Air for Board of Education, Rochester, New York.

Along with these are 535 F.M. radio, and 2,820 A.M. radio stations.

In New York state we have 21 television stations, 47 F.M. radio stations including eight non-commercial F.M. stations, and 109 A.M. stations including four non-commercial stations. Totaling up the commercial stations, we have 144 as contrasted to 21 television stations. From this you see the state as well as the national ratio of stations is about seven to one.

From these figures you will note that whereas television dominates with regard to the advertiser's investment, radio nationally, in terms of hours of broadcast, has around seven times as many hours on the air and the same is true here in New York State.

Now what does this mean to the conservationist? It means that his chance of getting his message on a medium are about seven times as good with radio as with television.

How can radio help to build a better conservation program?

First in radio, as elsewhere, there is no substitute for personal contact. So if there is any chance to do so, go to the radio station manager and talk over your program personally. As to the effectiveness of this approach, I can relate to some practical experience. Beginning in 1942, with the cooperation of three stations, I was able to build up a program on forestry over a period of nine years to where 54 A.M. and F.M. stations were using our College Forestry Journal radio program, either 26 weeks or 39 weeks in the year, with an estimated audience of about a million persons a week. If this may be considered evidence of some success in getting radio programs on the air, we can say that it came about largely because of close personal contact with station managers and program directors. Some valuable advice resulted from these contacts.

I recall the guidance furnished by one station manager on my query regarding whether or not we should attempt to set up some type of give-away teaser, to meet the competition of other radio programs. The response was a very positive *"No!"* "It would detract from the dignity of the program," he said. It was a lesson to me. Those of us who are representing state or federal organizations, regardless of much evidence to the contrary, have a professional rating in the public eye that carries with it an expectation of maintaining that "dignity" as we make contact with the public. As professional people that responsibility will increase as the public becomes more conscious of the breadth and depth of the conservation movement.

I realize that radio is a medium that most of you have used repeatedly, and that many of you have used it effectively in so far as individual broadcasts are concerned. You are well aware of the basic tenet that in dealing with the public there is the fundamental requirement to put forth the facts as accurately as it is possible to attain them. *The Biblical admonition "Seek ye the truth, and the truth shall make you free" is a positive guide for the conservationist at all times and certainly basic to a successful public relations program.* The truth does not aim to favor. The truth does not aim to curry favor. It remains as fact. Its function is to provide a long leverage in removing barriers to the attaining of difficult goals.

Don't Try to Cover Too Much

This emphasis on presenting the facts according to such light as we have, should not allow us to err and make the mistake of trying to cover too much in one program. The commonest mistake in radio is trying to squeeze too much material into one broadcast. While we may actually squeeze in all those pearls of wisdom, what we don't realize is that only two or three of the pearls are going to get past the eardrums and make a dent on the thinking of the individual. So as in conservation education work generally, simplify, simplify, simplify. A clean, sharp arrow makes the best penetration. Our broadcasts, likewise, register best when our thinking has been whittled down to a simple presentation of the bare essentials.

What about the time any of us should take for a broadcast? When our first Forestry Journal programs

went on the air, they were a full 14½ minute interview. This generally speaking is too long for an interview. The standards set by radio station WGY, in Schenectady, to limit Farm Paper of the Air broadcasts to 10 minutes for talk and 12 minutes for the interview are sound, in my opinion, except for the unusual speakers. On our Forestry Journal programs, we cut interviews to eight minutes, and both the radio stations and the audiences liked it better.

What about present trends in radio? Those of you cooperating with stations producing agricultural radio broadcasts know that one of your very best slots is on the agricultural broadcast by the so-called R.F.D. men at the larger stations in this state. But if you are feeding in taped recordings to these radio farm directors, you may find yourself limited to maybe three and one-half to five minutes.

Listeners Like It Brief

Does three and one-half to five minutes give you time enough? Yes, in my opinion. Chances are that the individual limited to four or five minutes on a subject may feel, at first, that his viewpoint is being slighted. A half hour at least is what his subject deserves! But what about the audience!

The radio switch is manned by highly maneuverable fingers—and it may not be elegant to say so—but the long winded performer usually doesn't stay on radio very long. The radio station, long in knowledge of listening habits, and short on catering to personal ego, is apt to have its way before long.

To sum up—thus far: The number of radio stations provides a much larger opportunity for program outlet than we realize. If we approach the radio stations with humility, and are willing to contribute segments to news and agricultural broadcasts, we may, with the kind of skill we bring to our presentation, find that on a particular station we may be producing programs, maybe say once a month, and later, with good luck and cooperation, as often as once a week. And so our conservation messages have the opportunity to grow more frequently as we develop skill and confidence with the station management.

If we keep in mind the objectives of our educational effort, we may learn from the psychologist and realize that frequent, shorter intervals of exposure to a subject are much more effective than long, less well trimmed talks, which while flattering to our ego, inspire the listeners to twist the dial to the fare from some other more understanding station.

Not Everyone Is Listening

Next to the fallacy of trying to get too much in one broadcast, is an equally fallacious assumption, that because you have just been before the microphone, you have actually "covered" the entire radio audience in that area. This is an easy assumption, and is almost always associated with beginning broadcast experiences. Rarely in the history of broadcasting does a critical or emergency situation arise, where most ears are figuratively "glued" to the radio.

To the contrary, listening habits vary greatly as surveys show. The man who listens to radio while milking may not be near a radio for the next 12 hours. And then when he is, he may be tuned to another station! Perhaps the only time a listener will be on is when he drives to work, and uses the car radio. Or it may be while eating, or preparing breakfast that he listens.

In some instances, a radio report on a meeting like this may best take the form of a paragraph sent to the local station which may include your release in its local broadcast as part of the news event of the day.

And that brings me to the subject of preparing our material in a fashion acceptable to the radio station. Careful preparation of material also makes for good public relations with our media. No matter whether on radio or television, good programs presented by an agency, contrary to what happens to old soldiers, really never die—that is, not in the mind of the program supervisor or program director. When you really produce a good program, it is not only good for your own agency, but good for the station management, as well as your audience.

The radio station is always concerned about building and holding an audience. This is literally the station's royal road to eating adequately. Usually, when we have completed a broadcast, we are glad that's over. Perhaps we should have the discernment to look beyond our broadcast occasionally and view the picture as the radio management sees it. If we make the extra effort to assist in building a radio station's audience with the station or stations working with us, we, in effect, team up.

Publicize Conservation Broadcasts

How may this be done? By taking such steps as are available to publicize our radio broadcast, first within our own agency, then by newspaper or special mailings. But—and this is the key—let the station know you are doing this. Such effort puts our agency in the position of a real partnership with the radio station, one in which our efforts are mutually beneficial.

One of the big advantages to trimming down your material to simple, single topics, is that this leaves you with an almost unending variety of approaches to your conservation concern, and consequently a continuous variety of topics to present to your radio audience. This emphasis on variety keeps a fresh approach before the listener and we hope it keeps him leaning on his radio receiver, wondering just what you are going to beguile him with next.

Figure 3. Unfolding the mystery of getting a wildlife census. Whether on radio or television, clarity of presentation is of the essence. Here Professor Ralph T. King at left, director, Roosevelt Wildlife Forest Experiment Station at State University College of Forestry in Syracuse, points out to Mr. Carlson and viewers of WHEN-TV the essential calculations in determining grouse population on section of Huntington Forest in the Adirondacks.

Where there is the opportunity, test out your listener's interest and participation by inviting him, or shall we say, intriguing him to respond to a broadcast. Offering a publication is one of the best examples.

Define Objectives Clearly

In my opinion the greatest need in most of our radio broadcasts, and the same can be said of television, is for setting up more clearly defined objectives in order that our broadcasts may be a step in the accomplishment of this specific objective. In making this suggestion, I am of course thinking of the adult audience rather than a school audience.

Suppose for example we consider another medium for a moment, that of publications, where our program chairman for this meeting has been particularly active.

Instead of generalizing in conservation, John Bulger turns out a "how-to-do" folder showing just how to build a house for a woodduck. This type of publication leaves the description of the woodduck and its interests to others. It is aimed toward a specific accomplishment, to get boxes built for the woodduck.

In many of our radio programs, we content ourselves with less clearly defined objectives. Consequently, the conservation program lags at this point, instead of our program being a vital spur.

Suppose, in contrast to being content with rather hazy objectives, we set up a whole series of radio programs, and that this series is not only planned in cooperation with our own personnel in a particular agency, but that we enlist the interest and enthusiasm of other agencies. This has the advantage of paving the way for cooperative action in the field with respect to other areas of the broad conservation program. It can bring new enthusiasm into program building, but best of all, it helps to create a feeling of accomplishment in the direction of a goal set up by the cooperating agencies.

What has been suggested here is obviously not new. The suggestion is really that we take a leaf from the experience of the advertising agencies, and move forward with as clearly defined objectives, and like the advertising agencies, have greater satisfaction from our concentrated effort because of the accomplishments which we can sense will grow from our cooperative effort.

I believe that in cooperative planning for both radio and TV programs lies a splendid opportunity. Where the Soil Conservation Service man sits down with the forester, the extension agent, the 4-H Club leader, the representative from the State Department of Agriculture and Markets, a sportsmen's organization, and perhaps, a businessman's organization, to plan whole heartedly to accomplish a well-defined objective—well, "something's gotta give!"

The coordinated effort has the prospect of bringing with it a new enthusiasm for the medium. Programs which may have gotten into a well-worn rut bounce out with new vitality. And where several state and federal agencies are cooperating, this new enthusiasm for use of the medium might even help convince the listener that he really is getting his money's worth from the tax supported agencies!

Any broadcast leaves in the listener's mind not only a residue of ideas presented, but a residue of the attitude of the conservation agency or organization presenting the program. This attitude which we reflect in our broadcast wings its way along with the words, and this broadcast of the spirit along with the words can likewise go a long way toward winning a better conservation program through radio.

Oklahoma's Living Grass Exhibit

M. D. GAMBLE

Three chapters of the Soil Conservation Society of America joined with cooperating groups to plant and maintain a living exhibit of grasses, forbs and legumes common to Oklahoma. It was located at the State Fair Park at Oklahoma City where it adds interest to the fair and serves as an outdoor laboratory for interested people. The SCSA chapters get a lot of favorable recognition through this project.

"I'VE BEEN a-seein' these grasses all my life and this is the first time I ever knew they had names," an "old-timer" was heard to say as he studied an information card for one of the native grasses in the Living Grass Exhibit at the State Fair Park in Oklahoma City, Oklahoma. Yes, they have names and give their best yield when recognized as a crop and properly managed.

Since Washington Irving's tour of the prairies, writers, ranchers and farmers have praised the virtues of the lush mantle of vegetation that made the prairies of Oklahoma famous. To see for ourselves, let's visit a living exhibit of the more important vegetation that is native to Oklahoma prairies which has been established at the State Fair Park in Oklahoma City.

State Fair and Exposition visitors have shown keen interest in the exhibit. Between 15 and 20 thousand people visited the plot last fall. This ambitious project, the only one of its kind in the state, was designed and is sponsored by the Soil Conservation Society of America through its state chapters in Oklahoma City, Ardmore and Tulsa. The Oklahoma Seedmen's Association furnished the signs. The Oklahoma State Fair & Exposition Committee furnished the grounds, all-weather walkways and help with maintenance of the plot.

The exhibit consists of 55 species of tall, mid-tall and short native grasses, with forbs (non grass-like herbaceaous plants) and legumes. For the visitors convenience

M. D. Gamble, a member of the SCSA, is agronomist, Soil Conservation Service, with headquarters in Oklahoma City, Oklahoma.

Over 50 kinds of grasses, legumes and forbs native to Oklahoma are growing in a living grass exhibit in Oklahoma City.

H. R. Wells, biologist, left, and M. D. Gamble, agronomist, discuss a Western wheatgrass planting. This native cool-season grass furnishes good food and cover for wildlife, as well as excellent grazing and erosion control.

each species in this selection of native plants is identified by an information card listing the common name, scientific name, distribution in the state and general value. For example: *Big bluestem, Andropogon gerardi; grows throughout Oklahoma, but is most common in the eastern half of the state; valued as a tall, very palatable, high forage producer; it is an important perennial warm season grass that will decline under continuous heavy grazing.*

A story about grass should refer to those eloquent words of John Ingall that "Grass is the forgiveness of nature, her constant benediction. Forests decay, harvests perish, flowers vanish, but grass is immortal. Its tenacious fibers hold the earth in place. It yields no fruit in earth or air and yet should its harvest fail for a single year famine would depopulate the world."

The exhibit serves as an outdoor laboratory. FFA and 4-H judging teams, competing in the National Land, Range and Pasture Contest, sponsored annually by WKY-TV, used the live species for an identification review before the contest.

Classes of foreign students visiting the exhibits are enthusiastically interested to find our most important native plants with scientific names and area of distribution.

Your Soil Conservation Society chapter can also have a living exhibit of the principle native grasses, forbs and legumes common to your state.

4-H and FFA groups have found the plots helpful for study and identification review. These two boys are studying Eastern gamagrass.

Conservation Problems on Solodic Soils In the State of Victoria (Australia)

By R. G. DOWNES

In this article the author briefly outlines some interesting problems as a result of land use in a particular type of country in south-eastern Australia. Much of the information presented and the explanation of the erosion problems are the result of work by the author and his colleagues in the Soil Conservation Authority of Victoria. Without quoting specific references in the article a list is given for those who desire to read further on the subject.

R. G. Downes

TO INCREASE PRODUCTION from the land, man inevitably upsets the ecological balance and in some types of country this starts a series of reactions which cause serious degradation of the area. Conservationists are then faced with ecological problems to find out why such reactions occur, and how they can be prevented and cured.

Man achieves true conservation only by devising for each different type of country systems of land use which provide the highest level of profitable production, together with a stabilized environment to ensure permanency of this higher production. In some types of country, drastic changes appear to have little or no ill-effect; consequently there is considerable flexibility in the kinds of land use which can be safely practiced. However, in other environments the natural balance is so delicately poised that relatively mild forms of disturbance cause changes which are most difficult to arrest and which, if left to continue unchecked, cause tremendous destruction. For these kinds of environments there is little flexibility in land use; the problem is to find the correct system of land use and management.

In the State of Victoria in south-eastern Australia, one particular environment provides an example of instability as a result of what had appeared to be a logical and relatively mild form of land use. It is of particular interest because some effects of this instability are unusual forms of erosion which have become evident only after about half a century of use.

The significance of the problem in Victoria may be gauged from the accompanying map which shows the widespread distribution of this kind of country in the central part of the State. The soils in this environment are solodic soils formed by the salinization and subsequent leaching of pre-existing soils to give the contrasting textures of surface and subsoil horizons and other peculiar properties to be described later.

In these areas significant disturbance of the natural vegetation, a dry sclerophyll forest, first occurred when they became more intensively settled about eighty years ago. Trees were thinned out and in some places completely removed to encourage a better growth of the existing perennial grasses of Danthonia and Stipa spp. or to enable cultivation. The land produced reasonably good native pastures which were used for sheep grazing.

However, these native grasses were not evolved under a system of constant and heavy grazing, but under a condition of occasional browsing by relatively few marsupials. Consequently, the original pasture was unable to

This map shows the distribution of solodic soils in the state of Victoria, Australia. All three problems—tunnelling, salting and molybdenum deficiency—occur here.

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maintain density and vigour under the constant grazing pressure irrespective of seasonal conditions, to which it was subjected by sheep. In addition, the increasing numbers of the introduced rabbit (a serious pest) added to the grazing pressure. It is hard to estimate the real intensity of grazing to which the pastures were subjected. Under this treatment the pastures thinned out and the bared soil was compacted, the surface became impermeable, productivity declined, and soil erosion became evident. The resultant increased runoff scoured the watercourses to form eroding gullies. But these were only preliminary warnings. About forty years ago it became evident that while these obvious effects of instability were developing, something else had been happening below the surface. About that time were observed the first signs of subsoil or tunnel erosion which has become a widespread and difficult problem.

Another problem then emerged—the development of excessive salinity in the soils along some of the creek lines, watercourses and lower parts of some slopes. At first it appeared to be a minor and transitory problem, but, like tunnel erosion, it too increased in incidence and extent, particularly during the past ten years.

Associated with these two problems, there was the difficulty of establishing improved pastures. Many attempts by landholders had met with outright failure, or at the best, only poor germination and lack of persistence. These failures for many years were attributed to climatic reasons, although the climatic data offered no support for such contentions.

Within the space of only eighty years a perfectly logical attempt at making better and more productive use of land had resulted in a degree of degradation in many places which never could have been imagined by the early settlers, and which seemed to offer nothing to the present generation but further deterioration at an ever-increasing rate.

But examining the environment in the light of present knowledge, it is apparent that these results were inevitable under the system of management imposed.

The Environment

Oceanic or "cyclic" salts are brought in by the rain and constitute the main source of salts accumulating in soils in the southern part of Australia.

The amount of salt brought in by rain varies from place to place depending on many factors. It is greatest in localities close to the coastline. More salt is brought in by a succession of intermittent, low intensity showers, rather than one heavy downpour. The direction of the prevailing winds and sundry other factors also affect the amount of salt deposited from rain. It is known from recent investigations that near the coast the amount can be 300 pounds or more per acre per annum, while 250 miles inland it may be as little as 5 pounds per acre per annum.

These amounts of salt are in themselves relatively insignificant, but in those areas where the relation between rainfall and evaporation precludes complete leaching of the salts through the soil and into the ground water, accumulation can occur and significant salinity will result. It is now thought that this accumulation and leaching of cyclic salt has been a dominant factor in the genesis of soils in south-eastern Australia.

In recent geological time there have been significant changes of climate which would enable considerable accumulations of salt during dry periods and their subsequent leaching during wet periods in certain zones which can be correlated with present day climatic limits.

The environment under consideration, occurs within the zone where there has been the greatest possible effect of such processes. The soils within this zone in Victoria, between the 20 and 30 inch average annual rainfall isohyets, have suffered the greatest degree of solodization. The most common and widespread soils are solodic soils which occur on all non-calcareous parent materials. The depth of the soils varies according to the kind of parent material.

In the particular type of country being discussed, the soils are formed on fine sandstones and shales and are relatively shallow, the average depth being 3 to 4 feet. They have a relatively shallow, poorly structured, compact loam surface horizon over a bleached structureless subsurface horizon beneath which there is a sharp transition to a heavy clay. This heavy clay subsoil has a moderate medium subangular blocky structure when dry, but when wet it disperses so readily that local farmers talk of the subsoils being "sugary" because they "melt" easily. In common with other solodic soils they are acid throughout, have low content of soluble salts and low amounts of exchangeable calcium.

The topography is rolling to hilly, and originally the area was covered by a dry sclerophyll forest of various species of Eucalyptus with an under storey of shrubs and perennial grasses. The rainfall ranges from 20″-25″ per annum, most of which falls during the winter months and this time of the year is the growing season. Rainfall during the summer comes mainly from isolated thunderstorms and is of little value for plant growth because of the hot conditions and high evaporation.

The hydrology of the environment is such that rainfall and evaporation approximately balance and consequently there are no permanent streams; but intermittent flood flows occur when rainfall intensity exceeds the infiltration rate of the soils in the catchments, or late in the winter when rain falls on catchments which are already saturated.

Under natural conditions a delicate hydrological balance existed and this has been upset.

Although the problems of this type of country are largely due to the character of the soils, the factors operating to produce such soils are themselves of importance, enabling the operation of processes which produce the problems.

Although in this environment the changes as a result of man's occupation are merely a reduction of trees in favour of grasses, and overgrazing of that grassland, the results of such treatment have indeed been spectacularly bad.

Tunnel Erosion

On some of the lower slopes of this type of country there may be numerous "fans" consisting of yellow or brown clay which has been washed out from small holes in the surface. Upslope from these outlets there may be lines of sink holes where the surface soil has collapsed into underground tunnels which have been scoured out in the subsoil providing the clay for the "fans." This is tunnel erosion, a most insidious form of degradation because of the amount of deterioration which occurs before there is any visible evidence of damage.

A full account of tunnel erosion and its origin has been given by the author elsewhere, but it can be restated briefly. Overgrazing and deterioration of pasture cover and subsequently the structure of the surface soil itself, is the prerequisite for tunnelling.

When the surface of these solodic soils is bare to the elements, the raindrop action causes a thin, impermeable crust to form. Consequently, there is an increase of runoff from most of the area and less moisture in the soil for plant growth. But in certain places there is an increase of infiltration because the rainfall, instead of soaking in where it falls, is concentrated into small hollows, stump holes and rabbit scrapes, which from measurements, are found to have an infiltration capacity of about 50 times that of the compacted soils surrounding them. In these particular places, especially after the dry summer, the rain soaks rapidly into the cracked subsoil, disperses the clay and carries it downslope until the wetting and swelling of the clay prevents any further such movement.

After many such wet and dry seasons the clay from beneath the hollow is removed, the hollow enlarges, and down the slope from it there is a partly formed tunnel in the subsoil; but nothing is visable above ground. At some critical time, probably the first autumn rains after a drought or a prolonged dry summer, the quick movement of water into the subsoil develops sufficient hydrostatic pressure at a point downslope for some of the liquid clay to be forced out through a crack or an anthole in the surface soil.

A small amount of clay extruded on the surface in this manner is the first indication of tunnel erosion. After the next dry season the clay shrinks and cracks to leave a complete channelway for water into and out of the subsoil and rapid scouring of the subsoil clay to produce the "fans" and further extension of the tunnel takes place.

Tunnels deepen and widen until the roof of the tunnel, the compact surface horizon of the soil, can no longer support its own weight. At this stage, when a tunnel may be four to six feet wide, the roof collapses and the tunnel becomes a gully. Tunnels join and extend underground and the sink holes through the roof are really where the better structured surface soil of collecting basins has completely collapsed into the tunnel.

Not only is the tunnelled area itself destroyed but the lower parts of the areas are damaged by the smothering

Tunnel erosion. Hills in the background are in an advanced stage. Hill in the foreground shows development of "fans" of outwashed clay from tunnels that have not yet collapsed.

This area has become badly salted. Note the lack of vegetation. Experimental reclamation plots are shown at the left.

of pasture by the raw clay being washed from the outlet holes to form clay "fans."

It is clear from this description of the development of tunnelling that its control depends on having a generally higher and more even infiltration rate over the whole area, rather than a lot of runoff and high infiltration at only isolated points.

The re-establishment and maintenance of an even vegetative cover to improve soil structure and to enable more even infiltration of water over the whole area is the basis for successful reclamation work. The tunnels must be thoroughly broken down, the area cultivated, and improved pastures sown, under a cover of a crop of rye which provides a bulk of straw to give surface protection while pasture is establishing.

Salting

On lower slopes and adjacent to watercourses in this type of country, there are to be seen occasional bare patches which are the result of excessive salinity. They vary in size, the largest ones being of the order of 50 acres. This is called salting and its occurrence has been known for some considerable time.

Recently there has been a tendency for it to increase both in incidence and area, some damaged areas now being several acres in extent. Apart from the loss of production on these salt-affected areas, they provide places where erosion can and does often start.

Salting results from an upset of the hydrologic stability of the area. The removal of trees to grow pastures is probably in itself insufficient upset to cause salting, but when there is overgrazing in the catchments and insufficient water use, the excess water seeps to lower levels carrying with it the small amounts of salt brought in by rain. In this way the small amounts of salt, if not used by vegetation, can by accumulation in a small part of the catchment become great enough to inhibit plant growth.

Good pastures over the whole catchment, skilfully managed to prevent overgrazing on either the upper slopes or potential salt patches, can prevent trouble. This is not easy because stock tend to concentrate on pastures growing on these potentially saline areas and denude them of vegetation. This decline in vegetation lowers the amount of slightly saline water being used by plants; the water is then evaporated from the soil surface and salt accumulates in the soil.

The onset of salting is first indicated by a change of pasture composition in these local relatively wet spots, the normal pasture giving way to more salt-tolerant species. If nothing is done to improve the situation there is a succession of degradation to halophytic species and ultimately to only bare ground.

Early recognition of salting enables rapid reclamation merely by improving water use in the catchments and fencing to keep stock from overgrazing the vegetation on the potential salt area. In the advanced stages reclamation is beset with all the problems normally associated with soils of high salinity.

Pasture Establishment

The establishment of improved pastures has always been a necessity on this type of country because even without erosion troubles, the productivity of the natural grasses was not great and their responses to fertilizers almost insignificant. It is clear from the nature of both tunnel erosion and salting, that the establishment of improved pastures represents the main possibility of reclamation of areas suffering from these troubles.

These soils, like most others in Australia, are deficient in phosphate and relatively low in nitrogen. The basis

of establishing improved pastures is the use of superphosphate to promote the growth of a legume which in turn builds up the nitrogen status.

Subterranean clover, an annual species, has been of major importance in the establishment of improved pastures in southern Australia, where the rainfall during the summer is insufficient for perennial species.

Attempts to establish subterranean clover on this type of country used to meet with little success, and failures were often attributed to various aspects of the climate. However, research work in recent years has indicated that these soils are deficient in molybdenum, and that two ounces per acre can make the difference between success and failure in establishing clover.

In view of the postulated mode of origin and genesis of these soils it is not surprising that trace element deficiency should be evident; these solodic soils are acid throughout and in the course of formation have been subjected to both acidic and alkaline leaching. In addition, the parent materials are sedimentary rocks of Ordovician and Silurian age and the material of which they are composed has probably been through several erosional cycles.

However, despite knowledge of the need for molybdenum, pasture establishment was not a straightforward matter These solodic soils are low in available calcium and it has been found that in the establishment of subterranean clover not only is molybdenum required in addition to the superphosphate, but also in many places there is a need for lime.

These new techniques for successful pasture establishment have enabled a tremendous improvement in the land use of this kind of country and the reclamation of areas damaged both by tunnel erosion and salting.

Modern Land Use

A better understanding of the environment has enabled the solution of these problems, and there has been an increase in productivity from the level of half a sheep to the acre up to, in many places, more than 2 sheep to the acre. Thousands of acres of the steeper parts of this kind of country are now being topdressed with fertilizers from the air, and many farmers have the idea that their land use troubles are now at an end.

Proper land use, however, is a dynamic thing in which the solution of one set of problems produces others. In this environment these recent advances in land use have undoubtedly enabled a higher level of production to be obtained with much greater stability than was possible merely by grazing the original natural pastures. Farmers, however, must now be prepared to face problems associated with this higher productivity. The management of the pastures to prevent clover dominance, which in turn causes animal health problems, will not be easy. For proper grazing management, larger numbers of stock, more intensive subdivision and better water supplies will be required and unless this situation is faced rationally and the modifications made, then the stability and higher productivity of these areas will be relatively short-lived and the onset of drier seasons could again bring disaster.

In fact, this environment and its past troubles and their solution together with the potential problems of the future are a clear indication that proper land use is not always easily achieved. It provides excellent reasons why it is vital to make the most detailed investigation of any environment in which it is proposed to make changes for intensive development and settlement. Only on the basis of such knowledge can possible problems be foreseen when determining the best form of land use for conservation. This outlook is particularly important in Australia and in some of the tropical countries where virgin land is still being developed, if conservation is to be achieved.

REFERENCE FOR FURTHER READING

Downes, R. G. (1946)—Tunnelling Erosion in N. E. Victoria—Journ. Counc. Sci. & Ind. Res. (Aust.) V.19 pp. 283-292.

Downes, R. G. (1949)—Soil Landuse & Erosion Survey Around Dookie (Victoria)—Bull. No. 243 Comm. Sci. Ind. Res. Org.

Downes, R. G. (1954)—Cyclic Salt as a Dominant Factor in the Genesis of Soils in S. E. Australia—Aust. Journ. of Agric. Res. V.5 pp. 448-464.

Newman, R. J. (1955)—Molybdenum Deficiency in Central Highlands and Upper Goulburn Regions and Adjoining Districts—Vict. Department Journ. of Agric. V.53 pp. 451-463.

Note the thick vegetation and lack of erosion. This shows what intelligent and balanced land use can do in spite of many tough management problems.

Suspended Sediment Characteristics of Ohio Streams

WILLIAM L. LAMAR AND CHARLES R. COLLIER

Sediment studies on the streams of an area can provide data for planning watersheds, pollution control and erosion control. Once corrective practices have been established, further studies can measure their effectiveness. In this article, the authors tell about sediment studies that have been conducted on Ohio streams.

THE LOSS AND HARDSHIP caused by floods are well known. The havoc produced by the water and mud to homes and factories is readily visualized.

Less spectacular but just as significant is this fact: Part of this mud is top soil eroded from the land. Actually, loss from continual erosion of land is much greater than the direct economic loss from floods.

The soil eroded from the land is a liability in our streams. The sediment in the water increases the cost of water treatment. It reduces the storage capacity of reservoirs, clogs harbors and navigable channels, and adversely affects aquatic life.

Water is the principal mechanical agent of erosion but wind, ice, volcanic action, gravity, and biologic activity also cause erosion. The sediment carried by streams is derived from erosion of the watershed. Thus, information on sediment carried by streams is valuable for many purposes.

It provides facts for watershed planning and for determining the effectiveness of measures taken as well as useful data for the understanding of sedimentation processes. It is valuable in planning measures for erosion and pollution control. The data are useful in reservoir depletion and trap efficiency studies. It also is very significant in the public and industrial use of water and in aquatic and fish management research.

Systematic studies of the sediment carried by streams provide significant and revealing facts on the extent, source, and movement of the sediment which are useful in the planning and application of remedial measures.

Typical sedimentation studies related to land and water stabilization programs are conducted in several ways. In one procedure a study is made of the sediment carried by the stream or streams in a selected area for a sufficient number of years to establish the normal regimen and provide planning data. The sediment studies are then continued for a sufficient length of time after the improvements have been applied to provide data on the effectiveness of the measures taken.

However, it is not always possible or advisable to follow this procedure. In this event, the sediment investigations may be conducted simultaneously in two similar areas under the same hydrologic conditions or under

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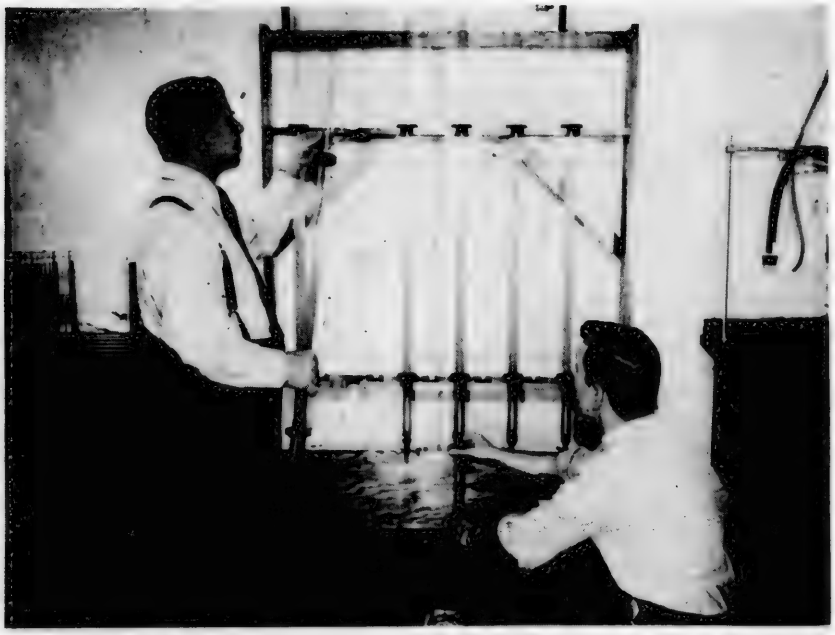
Charles R. Collier collects cross section sediment samples from the Sandusky River with a U. S. DH-48 sampler.



The authors, William L. Lamar, left, and Charles R. Collier, analyze the particle size of suspended sediment in several samples.

hydrologic conditions which can be equated. One area is used as a control and no improvements are applied. Improvements are applied to the other area and the benefits are measured by comparison.

By either of these procedures the harmful effects of man's activities may also be measured. Through these means, the manner and extent of sedimentation caused by strip mining may be studied. Such a study provides valuable information for planning control measures. Recognizing the need for these data, State and Federal agencies have recently begun a strip-mine study in Kentucky.

The cost of sedimentation investigations is small in comparison to the benefits. Stream improvement programs may be costly and the protection of that investment particularly justifies gathering basic information on sedimentation. Because of the lack of adequate sediment data, the value and useful life of many projects have decreased rapidly. Unforeseen difficulties in operation and maintenance have developed.

It is sound policy to provide basic sedimentation data for the economic planning of control of detrimental land use practices.

Particle Size Should Be Checked

An important phase of the sedimentation investigations is the determination of the particle-size distribution of the sediment. In a small watershed the sediment in transport may closely resemble soil characteristics for that area. However, for a large river basin it is necessary to have sufficient areal distribution of stations to define the contribution.

The particle size of sediment in transport is controlled by several factors among which are the type and erodibility of the soil in the watershed, the chemical character of the water, time and distance of transport, and flow characteristics such as velocity, turbulence, and roughness of the channel.

Particle size is one of the factors controlling the density of deposited sediment and is therefore necessary in determining the volume a given weight of sediment will occupy when deposited in a reservoir. This information is then utilized in the design of impounding structures and in predicting the probable life of existing reservoirs. In the design of water treatment plants for public and industrial use, it is advantageous to know the size of particles to be removed. The particle size as well as the concentration of sediment affects the amount of sunlight penetration which in turn affects the biological and aquatic life of a stream.

Sediment Is Carried Two Ways

It is convenient to discuss sediment as being transported by a stream in two general ways. The suspended sediment is transported by being held in suspension by the upward components of the turbulent currents or by colloidal suspension. Bed load is that sediment transported along and essentially in contact with the stream bed. This paper deals only with investigation of suspended sediment.

Many conditions cause variation in the suspended-sediment characteristics of the stream. Intense showers usually provide much more suspended sediment than the same quantity of water falling as a gentle rain. The condition of the soil is also important. If the soil is saturated, the runoff and sediment discharge will be greater.

In the early spring when the ground is saturated and thawing, the sediment yield is likely to be greater. Intense rains on freshly plowed ground, particularly on slopes, provide high sediment yield. Pasture and covered lands hold the soil. The network of roots, flora, humus, and duff on forested land is effective in retaining both the soil and water. In critical areas, particularly on steep slopes, forests are particularly valuable in decelerating erosion.

In order to provide sound information, suspended-sediment stations should be continued in operation for a sufficient period of time to observe normal, diurnal, and seasonal fluctuations in the sediment regimen of the stream. The period of operation depends on many factors, such as the characteristics of the stream, the variations in the hydrologic cycle, and the objectives of the investigation. Even for non-strategic stations, 5 to 10 years operation is usually considered a minimum.

Collection of Samples

Since the concentration and particle-size distribution of suspended sediment varies with the stream depth, velocity, and turbulence, special sampling equipment and techniques are used. Two types of samplers have been developed for the collection of representative samples of the water-sediment mixture.

The depth-integrating suspended-sediment samplers are designed to obtain a representative sample of the water-sediment mixture of the stream vertical. The intake nozzle and air exhaust are so designed that a filament of water enters the nozzle at a velocity theoretically equal to the stream velocity at that point. As the sampler is lowered to the stream bed and raised to the surface at a constant rate, the volume of water-sediment mixutre collected at each segment of depth is proportional to the velocity at that depth. Depth-integrating samplers now in general use in suspended-sediment investigations are the US D-43 sampler, which weighs 50 pounds; the US D-49 sampler, weighing 63 pounds; and the light US DH-48 sampler which is used for wading measurements.

The point integrating sampler is designed to collect a representative sample at any one point in the stream or in a section of the stream vertical. This sampler has an electrically operated mechanism for opening and closing the nozzle so that a filament of water-sediment mixture may be collected at any given depth or depths. The most common sampler of this type is the US P-46 sampler, which weighs 100 pounds. For very large streams having a high velocity, the US P-50 sampler, weighing 300 pounds, is used.

To obtain an accurate record of the suspended-sediment concentration, a variable sampling schedule is required. During periods of low water discharge, changes in concentration are normally gradual and can be defined adequately by sampling once a day. During storm-runoff periods when the water discharge is changing rapidly, the concentration of sediment also changes rapidly. To properly define the concentration curve during these periods, it is necessary to collect samples more frequently; for some streams as often as once every hour. For small flashy streams, half-hour interval collections may be necessary.

The variation in the concentration of suspended sediment across the stream is determined by periodic sediment-discharge measurements, particularly during flood stages. The samples are collected at selected points in the stream cross-section, so that each sample will represent approximately an equal portion of the stream flow. The concentrations of these samples are then averaged to determine the mean concentration for the stream.

Examination of Samples

The suspended-sediment samples are analyzed for concentration by determining the weight of the water-sediment mixture and the dry weight of the sediment. The sediment concentration is computed, in parts per million (ppm), by dividing the weight of the sediment by the weight of the water-sediment mixture and then multiplying by one million. The suspended-sediment discharge (load) is calculated in tons per day and the water discharge is computed in cubic feet per second (cfs). The records are computed on a water year basis. This is from

Suspended sediment samples are filtered in the laboratory. Information from these tests aids in reservoir design, watershed planning, erosion control and stream pollution control.

October 1 through September 30 of the following calendar year.

Because of the time required and amount of material needed, only selected samples are analyzed for particle-size distribution. These samples are selected so that wide ranges of water discharge and sediment concentration will be represented. In these studies, a combination of the sieve and bottom-withdrawal methods of analysis was used. By this method, the material is wet sieved to separate the particles in the sand-size ranges. All material passing the 0.062 mm sieve is then placed in a bottom-withdrawal tube filled with water. The material is evenly dispersed in the tube, the tube placed on a rack, and the particles allowed to settle. Withdrawals are taken at predetermined time intervals. The material in each withdrawal is dried and weighed, and the percent of the total sample in each withdrawal is computed. Using Stoke's law pertaining to the fall velocities of particles of various sizes, the percent of particles in the size ranges from medium clay to coarse silt is defined.

Distilled water is used as the settling medium to measure the size distribution of the individual particles since native water is likely to cause flocculation of the particles. However, native water is used as the settling medium to measure the particle aggregates that may exist under stream conditions. In these studies both distilled and native water settling mediums were used, although most of the particle-size analyses were made with distilled water as the settling medium.

Variation in Suspended Sediment

As previously mentioned, many factors cause variation in suspended sediment from day to day, season to season, and year to year. The monthly variation of water and suspended-sediment discharge of the Maumee River at Waterville for a two-year period is illustrated by Figure 1.

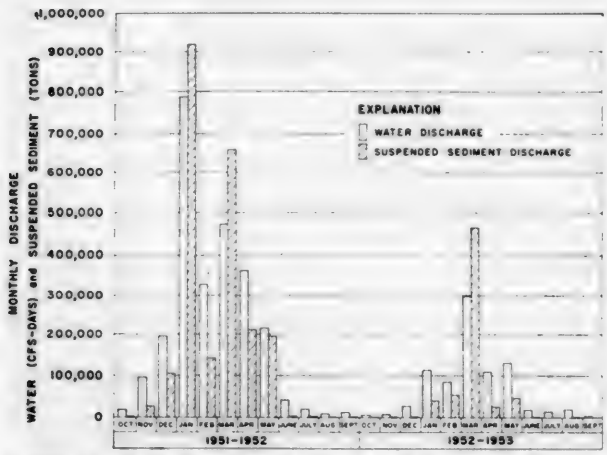


Figure 1. Monthly water and suspended sediment discharge on the Maumee River at Waterville, Ohio.

This figure shows that the suspended-sediment load exceeded 100,000 tons per month for six consecutive months during the 1952 water year with a maximum of 919,676 tons for the month of January. However, during the 1953 water year the suspended-sediment load exceeded 60,000 tons only for the month of March when the load was 465,077 tons. In February 1952 the monthly water discharge was greater than in May 1952 but the monthly sediment load was in the opposite order. The same condition occurred for several months during the 1953 water year.

Rapid changes in the suspended-sediment concentration during storm runoff are shown in Figure 2 for the

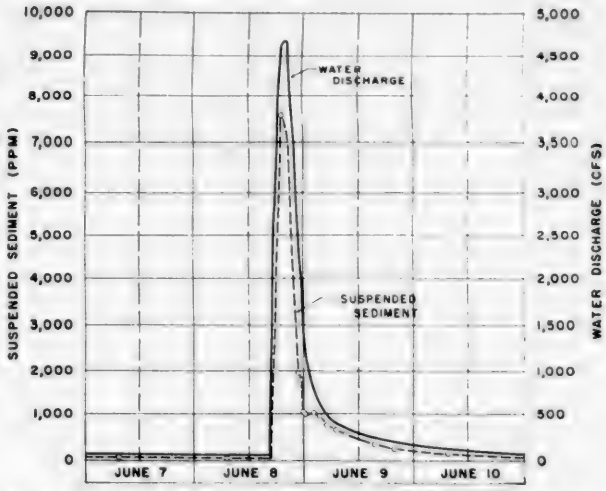


Figure 2. Rapid change in suspended sediment discharge following heavy storm on Little Miami River, Oldtown, Ohio. This is typical of small, flashy streams.

Little Miami River near Oldtown for June 8 and 9, 1954. This rise was the result of a heavy local storm in the area around Yellow Springs, Ohio, on the afternoon of June 8. The hydrograph is typical of a small, flashy stream. The concentration increased from 23 to 7,550 ppm in about two and one-half hours. Five hours later it had fallen to about 1,000 ppm. The suspended-sediment load for the two hours, 6:00 to 8:00 p.m., was 7,300 tons, nearly half of the total for the entire water year. On June 8 this stream carried 13,600 tons of suspended sediment while for the rest of the entire water year it carried only 1,538 tons. Thus 90 percent of the suspended sediment was discharged in one day.

The hydrograph of a storm runoff on a larger stream, the Muskingum River at Dresden, is given in Figure 3. The shape of these curves is typical of rises on larger streams. Changes in the concentration are not as rapid and the rise is spread over a much longer period of time. These concentration curves quite often have more than one peak.

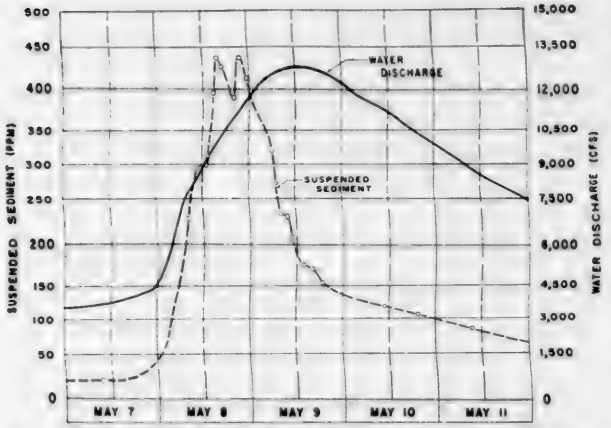


Figure 3. Storm runoff on Muskingum River at Dresden, Ohio. This curve is typical of changes found on the larger streams.

For the Maumee, Portage, Sandusky, and Cuyohoga Rivers the water discharge was much higher for 1951 and 1952 water years than for the subsequent 1953 and 1954 water years. The total suspended-sediment discharge was also lower in 1953 and 1954.

However, the sediment yield in terms of tons per acre-foot runoff was greater for some of the years of low water discharge.

For example, results for the Maumee River show 0.429 ton per acre-foot of runoff for the 1954 water year and 0.321 ton for the 1951 water year. For the Portage River, tons per acre-foot of runoff was greater in both the 1953 and 1954 water years than in the 1951 water year. At the Sandusky River near Fremont the annual sediment yield in tons per acre-foot was lowest when the total water discharge was highest. The sediment load of the Cuyahoga River at Independence was quite low in the 1953 water year as compared to the other three years recorded.

The sediment discharge rates were low in the upper Little Miami River basin in the 1953 and 1954 water years except during a flash flood at the Oldtown station in 1954. The water discharge was also considerably below runoff is estimated to be about 13 inches.

The largest stream on which sediment investigations were made, Maumee River at Waterville, carried the most suspended sediment. The total load carried by this stream ranged from 641,325 tons in the 1953 water year to 2,268,287 tons in the 1952 water year. The sediment yield per square mile of drainage area ranged from 6.68 tons per square mile for the Little Miami River near Selma for the 1954 water year to over 405 tons per square mile for the Portage River at Woodville for the 1952 water year.

Streams may show considerable variation in sediment yield per square mile for different water years. The largest variation recorded was from 56.2 to 381 tons per square mile for the Cuyahoga River at Independence. The maximum sediment discharge in any one day was 142,000 tons for the Maumee River at Waterville. The minimum sediment discharge for all streams for the period of record ranged from less than 0.05 ton to 8 tons per day.

Particle Size Graduation

In general the suspended sediment carried by the streams investigated in Ohio is in the silt and clay size ranges with little or no sand present. However, for the Cuyahoga River at Independence and Todd Fork near Roachester as much as 9 and 16 percent sand respectively has been measured.

For the period October 1952 to September 1954 at low suspended sediment discharge on the Todd Fork near Roachester, 88 percent of the material was in the clay size range, 11 percent silt, and one percent sand. At high sediment discharge 57 percent of the material was clay, 38 percent silt, and 5 percent sand.

Summary

Thirteen daily suspended-sediment stations are now being operated in Ohio. The first suspended-sediment station under this program was started in 1950 and the first complete water year of operation was for the period October 1950 to September 1951. The period beginning with the 1951 water year through the 1954 water year covers a total operation of 35 complete station years. During this period a total sediment discharge of 9,651,300 tons was measured. However, this total represents minor duplication due to the inclusion of two upstream stations and one downstream station in the Little Miami River basin. On the basis of downstream stations only, this record covers 31 complete station years with a total sediment discharge of 9,649,000 tons.

Since many conditions cause variations in suspended sediment discharge, short-term records are likely to be misleading. For example, the Little Miami River near Oldtown in a two-year period carried a total load of 18,357 tons of suspended sediment. However, 13,600 tons or 74 percent were carried in one day.

The study of suspended sediment carried by streams in Ohio has been revealing and it has helped focus the attention of hydrologists and the public in general on the nature and extent of the sedimentation problem. It has provided sound information on the sedimentation characteristics of particular streams and areas.

The suspended-sediment studies reveal the importance and value of soil and water conservation programs and they provide a means of determining the effectiveness of measures used in these programs. The results of sedimentation studies provide a basis for planning and undertaking of remedial measures in a sound manner where the most economic return can be expected.

The International Union for Conservation

Here is a report of the recent International Union for Conservation meetings. Previously, the group was known as the International Union for the Protection of Nature.

THE INTERNATIONAL Union for Conservation held its Fifth General Assembly and Technical Meetings at Edinburgh, Scotland, June 19-28, 1956. In attendance were more than 300 delegates and observers from some 30 countries throughout the world. The United States was well represented by conservation leaders, including H. H. Bennett, Ira N. Gabrielson, Fairfield Osborn, Lloyd W. Swift, John H. Baker, Harold J. Coolidge, R. W. Westwood, Roger Tory Peterson and Hugh M. Raup.

Edward H. Graham, president of the Soil Conservation Society of America, and Mrs. Graham, were also in attendance. Dr. Graham is vice president of the Union's Commission on Ecology. He served as co-rapporteur of one of the technical sessions at Edinburgh and presented a paper in the session on the relationship of ecology to landscape planning.

The meeting this year emphasized the scientific basis for the orderly development of the world's renewable natural resources. One of the most lively sessions dealt with the need for bringing together the work of those who deal with rural lands and those who are struggling with problems of rapidly developing urban areas. There was considerable attention given to rehabilitation of areas disturbed by soil erosion, water pollution and surface mining, and the need to relate the structural works of engineers with the vegetational activities of agriculturists and foresters.

Several papers were given on the scientific management of parks, nature reserves and recreational areas. A special session was devoted to myxomatosis, a virus disease of rabbits, which has caused the near extermination of these mammals in Britain and western Europe, with resulting changes in vegetation having profound effects upon agriculture, forestry and other land-use activities in that part of the world.

The International Union for Conservation, previously known as the International Union for the Protection of Nature, held general sessions at Brussels, 1950; Caracas, 1952; and Copenhagen, 1954, after its organizational meeting at Fontainebleau, France, in 1948. In alternate years, until last year, it held technical meetings. In the future, combined general and technical meetings will be held biennually. The next conference is scheduled for Athens, Greece in 1958, with one of the major themes to be soil and water conservation in Mediterranean and tropical climates.

At Edinburgh, Roger Heim, director of the Paris Museum of Natural History, was re-elected president of the Union. Lord Hurcomb, United Kingdom; Victor Van Straelen, Belgium; and Enrique Beltran, Mexico, are vice presidents, and Tracy Phillips, United Kingdom, is secretary general. Headquarters of the Union are at Brussels, Belgium. American representatives on the executive board are R. W. Westwood and Ira N. Gabrielson from the United States and Abbe Ovila Fournier from Canada.

The International Union for Conservation is the only organization of international scope that brings to bear upon the care and use of natural resources the combined attention of highly competent individuals from the biological, physical and social sciences. At Edinburgh there were in attendance biologists, soil scientists, foresters, agriculturalists, engineers, rural and urban planners and others with both scientific and administrative responsibilities. This inter-disciplinary approach to the technical development of natural resources on a world-wide scale is a unique feature of the Union's objectives and activities.

At the meeting, as in the staff activities at Brussels and the work of the Union's various Commissions, attention was given to both commodity and non-commodity values of natural resources and the environment that provides them. The original interest of the Union in parks, nature preserves, and rare and vanishing species of plants and animals has expanded to include concern with the practical as well as the aesthetic value of landscapes, including agricultural, forest and other land and water development programs. This concern with a pleasant and attractive, as well as a productive, environment is an expression of an ethical approach to conservation that is strong in the minds of many who support the Union.

Following the Edinburgh sessions several excursions were offered those who attended, and many of the participants saw something of the land-use problems in the Scottish Highlands. An exemplary feature of the country's conservation program is the way in which the Scottish Hydroelectric Board is developing a vast network of power dams while at the same time using the most modern methods of preserving the very valuable salmon runs and minimizing the disturbance to the natural landscape. Extensive plantings of coniferous forest by the United Kingdom's Forestry Commission were observed, as well as the great expanses of moorland, long grazed and burned

for sheep and grouse production, which pose a primary land-use problem.

The Royal Commission on the Common Lands has been examining the possibility of more productive use of these extensive moorland areas throughout upland Britain and a very helpful report has just been published by Britain's Nature Conservancy on the ecological approach to the management of these lands, including the need for an adequate system of land classification.

On his return from the meeting Dr. Graham stated that "the broad interest in all aspects of conservation and the concern with integrated consideration of resource management which is characteristic of the International Union for Conservation brings its primary purpose close to that of the Soil Conservation Society of America. The two organizations have much in common, and there is a great deal to be gained by close liaison between the two organizations in the future."

Legume Inoculation—Wet or Dry?

By Francis E. Clark

Bacterial inoculants for legumes can be applied to the seeds at planting time either with or without the use of water. In the past, water has been used more often than not. Either the seed itself is moistened lightly prior to adding the bacterial inoculant or else sufficient water is mixed with the inoculant to make a thin paste which in turn is mixed with the seed. Either of these procedures is known as "wet" inoculation.

In "dry" inoculation, the bacterial inoculant is added directly to the dry seed in the planter or drill box. The practice appeals to operators because it eliminates any extra or pre-planting handling of the seed and inoculant. It also eliminates the danger of seed-coat swelling and shedding with such seeds as soybeans, as well as the possibility of having to dry the wet seed should inclement weather delay planting operations. These latter troubles are commonly due to use of too much water or to the mixing of too much wet seed in advance. There is no gainsaying the desirability of using the simplest operation compatible with satisfactory results.

Several manufacturers of legume inoculants now advertise that their inoculants can be added either wet or dry. Others are recommending that dry inoculation be used only on large-seeded legumes such as soybeans and that wet inoculation be practiced on small-seeded legumes. Still others recommend only wet inoculation. Information concerning the relative efficiency of the two methods remains very scanty.

In response to inquiries directed to the Soil and Water Conservation Research Branch, asking about the extent of inoculant retention with and without water, tests have been made on laboratory-prepared humus inoculants with known bacterial and moisture contents. Wet and dry treatments were made with inoculants added to seeds at the usually recommended field rates. All results were computed to show per cent of viable legume bacteria retained on and transferred with the seed in relation to the total number of such bacteria available for transfer.

In four separate experiments designed to introduce several known handling variables, retention of bacteria on dry-inoculated soybeans ranged from two to nine per cent of the number initially applied, and on wet-inoculated soybeans, from 43 to 62 per cent. For red clover seed given dry inoculation, retention was from 26 to 48 per cent; given wet inoculation, from 43 to 77 per cent.

Tests were also made using a number of commercial inoculants purchased on the open market. Each inoculant was compared for its relative retention on wet and dry seeds of soybeans and red clover. These were again chosen to represent large-seeded and small-seeded legumes.

The same pattern of results was obtained with these inoculants as with the laboratory preparations, even though measurements were made by a different procedure. Following application of the inoculant to seeds, the amount of humus inoculant recovered by thorough washing was measured by turbidity methods using a standard colorimeter and a "540" filter.

Inoculant retention on dry soybeans averaged eight per cent; on wet soybeans, 83 per cent; on dry clover, 31 per cent; and on wet clover, 86 per cent.

Inoculants Were Not Compared

No tests were designed fully to compare one commercial inoculant against another, but the several inoculants that were used did not differ appreciably one from another in their ability to adhere to seeds. It was also obvious that dry inoculation appeared more successful on red clover than on soybean, but for both legumes, wet inoculation was distinctly superior.

Taken at their face value, the results indicate that if a given quantity of a soybean inoculant is satisfactory when applied dry, then that same quantity of inoculant would be equally satisfactory for up to five times as much soybean seed if applied wet, assuming that the inoculant that is separate from seeds does not drill at all uniformly with the seeds. Making the same assumption for red clover, inoculant requirement would be cut approximately in half by using wet inoculation. Until field evidence is available that the fractional retention secured by dry inoculation is entirely adequate, it appears safest to employ wet inoculation at the presently recommended rates.

Francis E. Clark, microbiologist, Soil and Water Conservation Research Branch, Agricultural Research Service, Beltsville, Maryland.

Book Reviews

IOWA FISH AND FISHING. EDITED BY JAMES R. HARLAN AND EVERETT B. SPEAKER, *Iowa State Conservation Commission, East 7th and Court Avenue, Des Moines, Iowa. 1956. 377 pp. $2.50.*

The color detail of 63 species of fresh water fish defined with extreme accuracy by artist Maynard Reece will make the color prints in this book delight biologist and fisherman alike.

In addition to the color prints, detailed descriptions of fish and keys for indentification will prove useful. Helpful angling hints are included for fishermen. The sections on lures and baits—both natural and artificial will also prove helpful. Ideas and suggestions for effective use are included. They make good reading for any fisherman.

For those who especially want to know about Iowa fishing, details of Iowa's fishing waters are covered. A directory of lakes, rivers, state-owned public access areas, and reservoirs is included. Distribution of the various fish within the state is also covered.

Copies of 18 color prints of the 63 species of fish, suitable for framing or filing, are available at a cost of $2.00. These color prints are on a green background measuring 7¾ by 11½ inches.

—JOE STANTON, *Des Moines, Iowa*

MAN'S ROLE IN CHANGING THE FACE OF THE EARTH. *University of Chicago Press, 5750 Ellis Ave., Chicago 37, Illinois. 1193 pages. $12.50.*

For the review of the book, please turn to the President's Column on page 251.

FROM FOREST TO FRONT PAGE. BY ROSCOE C. MARTIN. *University of Alabama Press, 66 pages, illustrated. 1956. $1.25.*

The report, *From Forest to Front Page*, deals with the establishment of the $60,000,000 newsprint manufacturing plant of the Bowaters Southern Paper Corporation at Calhoun, Tennessee. The study was financed from a grant from Resources for the Future, Inc., to the Inter-University Case Program for studies of administrative aspects of natural resource problems. It covers a ten-year period leading up to the Calhoun plant's opening in 1954.

Part one describes selection of the plant site and the Bowaters company's relations with federal agencies in the obtaining of a Certificate of Necessity.

Part two covers subsequent negotiations with regional state and local government. Both parts of the report deal extensively with underlying problems of resource policy.

CONCEPTS OF CONSERVATION: *A Guide to Discussion. The Conservation Foundation, 30 E. 40th Street, New York City. 48 pages. 1956.*

"Why is this resource vital to our prosperity? How critical is the situation with respect to supply in view of demand? What major factors are involved in its optimum use?"

Concepts of Conservation is admirably designed to help interested citizens work out sound answers to such basic queries. The Guide concentrates on four major fields: fresh water supplies, agricultural lands, forest resources and management, and animal life—all involving lively, controversial, and often perplexing issues. Emphasizing the interrelatedness of all resources and our dependence on them, the Guide summarizes the status and trends in each field, suggests fruitful topics for study, and lists references and other educational materials for those wishing more details.

Each discussion divides into several topics. For example, *Water Supplies* includes pollution, irrigation, municipal needs, floods, and watershed protection. Discussion on the last topic cites the recent "remarkable increase" in watershed associations throughout the country. "In no other area are the interlocking relationships between soils, forests and other crops, animal life and water more evident than here."

Leading statements or questions suggest the kind and amount of emphasis each aspect might receive. Thus, subtopic 3, Regional Planning and Agricultural Zoning, under *Agricultural Lands*, reads: "Urban encroachment on formerly productive farm lands tends to increase local land values, and at the same time to increase the tax load to a point where many a 'family sized' farm has to be abandoned for other land uses."

The value of timberlands for other uses besides wood receives appropriate attention also: "Forests provide millions of people with recreation. . . . The country should especially preserve the few remaining areas of virgin forest in our national parks. These areas, remnants of a

national heritage, have unique importance both for scientific research and as wildlife refuges."

Similarly the section, "Predation—A Much Misunderstood Subject," startlingly brings home our dependence on wildlife. "If all birds of prey, all predators, mammals, reptiles, and fishes, were destroyed overnight, the long-range effects might be even more disastrous for the American people than if a number of hydrogen bombs were dropped on Chicago and New York."

A final section proposes discussion of the view that explosive population growth, spreading developments and faster transportation—all intensifying the pressures and conflicts over resources—may require additional public controls as well as education to minimize unnecessary waste and destructive exploitation of our natural wealth.

Concepts of Conservation has unquestioned value for all groups already conscious of resource problems in their own back yards, regions, or nation. Urban and suburban localities, where the bulk of our people now reside, might seem the most difficult to arouse, but the expanding membership of conservation organizations and the awareness created by the recurrent campaigns to save our parks, wilderness, wildlife, and fisheries promise a wide and favorable reception for this well-balanced and thoughtfully prepared pamphlet.

—BERNARD FRANK, *Washington, D. C.*

1952-1955 Illinois Drought. BY H. E. HUDSON, JR., AND W. J. ROBERTS. *Bulletin No. 43. State Water Survey Division, Urbana, Illinois. 52 pages. 1955.*

Here is a publication that contains suggestions for estimating sizes of reservoirs needed to insure adequate public water supplies during drought years for Illinois municipalities.

Methods pointed out by the publication consider the need to plan for severe droughts, loss from evaporation and accumulation of silt in the reservoirs. The publication further shows that 75 Illinois communities had water shortages during the three-year period 1952-1955.

The 1952-55 drought was of a severity that would occur once in approximately 83 years. Severity was judged on the basis of long-time streamflow records which the State Water Survey has developed in cooperation with the United States Geological Survey.

Irrigation and Allied Research in the Bombay State. *Annual Report No. 21.* BY SHRI R. L. PHANSALKAR, *Irrigation and Development Division, Poona 1, India. 174 pages, illustrated. 1955.*

Here is a detailed comprehensive report that covers thirteen areas of activity in irrigation and allied research. It shows how problems were delineated and solved. The tables, charts, photographs and maps are not only impressive but also reveal to the outsider that the techniques used to set up a program in the Bombay State are somewhat similar to those used in the United States.

Mr. Shri R. L. Phansalkar, author of the report, is the executive engineer for the Irrigation Development Division of the Bombay Public Works Department.

An Inventory of Water Resources and Water Problems—Des Moines River Basin, Iowa. *Bulletin No. 1. Prepared by the Iowa Natural Resources Council, State House, Des Moines, Iowa. 64 pages, illustrated—charts and photos. 1955.*

An Inventory of Water Resources and Water Problems—Nishnabotna River Basin, Iowa. *Bulletin No. 2. Prepared by the Iowa Natural Resources Council, State House, Des Moines, Iowa. 61 pages, illustrated—charts and photos. 1955.*

An Inventory of Water Resources and Water Problems—Iowa-Cedar River Basin, Iowa. *Bulletin No. 3. Prepared by the Iowa Natural Resources Council, State House, Des Moines, Iowa. 94 pages, illustrated. 1955.*

These reports are the first in a series of similar river basin studies now in progress in Iowa. The subjects covered include an inventory of the available water supply, an evaluation of the demands this supply must meet, a summary of past flood experiences within the basin and recommendations for comprehensive development of the basin's resources.

The reports are exceptionally well done and may easily serve as a general pattern for similar studies elsewhere. Each report contains many excellent photos, charts, graphs and tables—all of which makes for easy reading and interpretation.

Ohio's Conservancy Districts. PREPARED BY S. L. FROST. *Ohio Forestry Association, Columbus 15, Ohio. 28 pages. 1956. 50 cents.*

Ohio's Conservancy Districts shows the status of 26 districts established since the conservancy law was passed 42 years ago. The report also indicates that more than half of the watershed drainage area of Ohio is now covered by conservancy districts, but that financing problems, legal entanglements and lack of educational efforts to properly explain the projects to local citizens, have stalled some of the district programs. Notable progress has been made in many districts such as the Mukingum and Miami projects.

The new publication lists the location, officers, purposes

and accomplishments of each district, as well as giving information on the conservancy law, its legal problems, and the procedures in organizing districts. It is the first listing ever published of the districts. The report also shows how the conservancy program has been used for water conservation, drainage and other purposes. Some of the districts have been sponsors with soil conservation districts for the development of small watershed flood control improvements in cooperation with the federal government.

Bibliography of Land and Water Use in Europe. BY C. H. EDELMAN AND B.E.P. EEUWENS. *Food and Agriculture Organization of the United Nations. Rome, Italy. 347 pages. 1955. $1.50.*

This work was done by FAO's Sub-committee on Land and Water Use of the European Committee on Agriculture. Listed are books, pamphlets and papers covering general agriculture, geography, climate, vegetation, hydrology and hydrography, land reclamation, drainage, irrigation, consolidation of fragmented holdings, soil erosion and soil conservation. Many of the listings are in the language of the country in which the material originated.

People and Timber—*A Review of America's Timber Resources. Miscellaneous Publication 721, Forest Service, United States Department of Agriculture, Washington 25, D. C., 20 pages, illustrated. 1956. 20 cents.*

This booklet is based on the Timber Resource Review, a three-year study made by the Forest Service of the United States Department of Agriculture with the collaboration of the state foresters, state agencies, forest industries, and other private and public organizations.

The annual timber cut, according to the booklet, is 48.8 billion board feet. By the year 2000, timber needs will rise to 80 to 100 billion board feet a year because of an expanding economy and an increased population. These increased needs can be met if every acre of forest land is put under good management, the study says. The booklet points out along what lines improvements in forests can be made.

According to the Forest Service, improved methods of forest management are most needed on the farm and other non-industrial private timber holdings, most of them less than 100 acres in size. These farms and other non-industrial private ownerships comprise about 60 per cent of the commercial forest land in this country. In addition to farmers all walks of life are represented; businessmen, professional people, housewives, retired folk, and others not connected with the forest industry.

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The progress made in the last decade, the booklet points out, indicates what can be done. The growth of softwoods in the East now exceeds the cut of softwoods. Productivity is relatively good on forest industry and public lands. Gains are being made in forest fire prevention and control. Wood is holding its own as an industrial material with consumption at an all-time high.

Yearbook of Forestry Products Statistics. PREPARED BY THE FORESTRY DIVISION OF FAO. *International Documents Service, Columbia University Press, 2690 Broadway, New York 27, New York. 161 pages. 1955. $2.50.*

This is the ninth *Yearbook of Forest Products Statistics.* It was prepared by the Forestry Division of FAO and contains information from more than 120 countries for 1954. Each section of the Yearbook is published in English, French and Spanish.

Some of the sections covered include processed wood, wood pulp and pulp products; world trade in forest products; forest products other than wood, and comparative data.

Field Notes

Michigan Natural Resources Council

A Michigan Natural Resources Council was organized "To advance the attainment of sound management of natural resources in the public interest."

The function of the Council is to effect closer cooperation between the many organizations operating in Michigan who are concerned with the conservation of the natural resources. The Council will also provide them with information on policies and actions taken by federal, state and local agencies affecting the natural resources, and make available to the members scientific data and other information pertinent to conservation problems. However, the Council *"shall not undertake to control the policies or actions of member organizations, and it shall be non-political and shall not be a lobbying organization or promote the candidacy of any person seeking public office."*

According to the by-laws, membership is reserved to private and public groups, each being represented by one member on the Council. There are over fifty private organizations eligible to membership as well as about twenty-five federal, state and local public agencies.

A Serious Land Use Problem

Photo Courtesy Soil Conservation Service

Many tall tales are told about farming in the Southern Appalachian Mountains; where, because the slopes are so steep, farmers have to plant their corn with shotguns from adjoining hills—and how careful they must be to keep from falling out of their fields. But here is positive proof of the use of really steep slopes in Puerto Rico. The small amount of land available for crops and the large number of people make it necessary to plant tobacco in a field so steep that a man can lean up against it.

SCSA Signs With ICA to Provide Help For Foreign Scientists

The Soil Conservation Society of America has been selected as one of seven U. S. professional societies to initiate a cooperative program with the International Cooperation Administration (ICA) in maintaining contact with foreign technical specialists who have received training in this country under programs sponsored by ICA.

The seven associations will offer foreign specialists memberships, subscriptions to technical journals; bulletins and other publications of practical value; personal answers to requests, and assistance, if desired, in forming professional societies in their own country.

Seven U. S. professional societies have already started the project to test the effectiveness of the plan. Fifteen others will comprise a second group for expanding the program. Eventually as many as 140 organizations and 31,000 foreign technical specialists may participate.

The other organizations in the initial group are the American Public Health Association, American Nurses' Association, American Home Economics Association, American Statistical Association, American Society for Public Administration, Society of American Foresters.

The initial contract between ICA and the Soil Conservation Society of America is for a period of three years. Since incomes in most newly developing countries are much lower than for comparable work in the United States, ICA, from technical cooperation funds, will meet a major portion of the costs.

Names of the individuals trained in the U. S. during the past several years will be supplied the Society by ICA. They will be contacted and offered a corresponding membership. The individual will be asked to pay $1.50 (U. S.) for a one-year period or $4.50 (U. S.) for a three-

year period. ICA will pay the Society $4.50 (U. S.) additional for each year of membership.

Many of the foreign technicians who have had advanced training in America under ICA's technical assistance programs are from newly developing countries where there are few if any professional associations. Until organizations can be set up in these countries, it is hoped that U. S. professional societies can help to bridge the gap. The ultimate goal of the entire program is to link persons of a given profession—both in a spirit of fraternity and in sharing "know-how" with each other—on a worldwide basis.

Many of the foreign health, agriculture, education and other personnel, who have received training in the United States, declare following return to their homelands one of their greatest needs is to keep in touch with United States developments in their respective fields.

Study by foreign technical specialists from 51 nations in the United States has been an important part of various technical and economic asistance activities of ICA. Except for Greece and Turkey, Europe is not included at this stage of the program, since, in most European countries, professional associations have been in existence for years.

In a preliminary series of interviews with 500 participants in 16 countries ICA found that without exception they welcomed this opportunity to keep in touch with their American colleagues.

They deemed it of paramount importance that they should "keep up" with new developments and new techniques in their fields. The individuals pointed out, too, that in their efforts to bring about needed changes, their recommendations would carry the added prestige afforded by their status with United States professional asociations.

Land Zoning Needed For Wisconsin Forest Lands

Many people make demands on Wisconsin's forests for many things — pulpwood production, lumbering, Christmas tree production, recreation, and wildlife management.

Some of the problems arising as a result of the increased pressures for different uses of forest land and some of the solutions that can be achieved through rural zoning were discussed by two panels of speakers at the summer meeting of the Wisconsin Chapter of the Soil Conservation Society of America.

Sixty-four members and guests participated in the meeting held July 27-29 at the Trees for Tomorrow Camp in Eagle River. Eleven speakers taking part in the discussions represented the University of Wisconsin, Agricultural Extension Service, Wisconsin Conservation De-

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Vegetation and Watershed Management

E. A. Colman, *U. S. Forest Service.* Systematic appraisal of the methods of managing vegetation in watersheds to increase ground water supplies, check soil erosion and siltation, reduce flood peaks. Describes effect of vegetation on runoff, infiltration, storage, etc. A Conservation Foundation study. ***24 ills.; 412 pp.*** **$7**

Irrigation Development and Public Water Policy

Roy E. Huffman, *Montana State College.* A full account of the socio-economic aspects of irrigated agriculture and public water policy in the United States. Explains financing, planning, organizing, and operating irrigation projects. ***19 ills., tables; 336 pp.*** **$6.50**

The Flood Control Controversy

Luna B. Leopold, *U. S. Geological Survey; and* Thomas Maddock, Jr., *U. S. Bureau of Reclamation.* Clarifies both technical problems and economic and political issues in flood control. Evaluates upstream and downstream programs, giving a realistic basis for judging proposed flood protection measures. A Conservation Foundation study. ***31 ills., tables; 278 pp.*** **$5**

Conservation Law and Administration

William F. Schulz, Jr., *University of Pittsburgh School of Law.* A comprehensive study of a state's conservation laws and the administration of its renewable natural resources. Using Pennsylvania as a yardstick, it offers a blueprint to guide conservationists in all states. A Conservation Foundation study. ***34 ills., tables; 607 pp.*** **$10**

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partment, U. S. Forest Service, the paper industry, the resort industry and newspapers.

In past years, logging, uncontrolled fires and land settlement for general farming desecrated our northern forests and forest land. Over the years, planting, resettlement, helpful legislation and zoning have helped develop northern forest land. This has started a trend toward clearer lakes and streams and an abundance of green growth commercially valuable as wood and as recreation for millions of tourists. But, there are still conflicts in land use arising from demands for using the same land for many purposes. The pressure of an increasing population and an increasing demand for recreational facilities must be recognized.

The major uses of the land in the north are for timber and wildlife production, agriculture and recreation. Both public and private forests are managed for sustained yields of timber. The paper industry has also supplied over a million tree seedlings to different land owners to help maintain a supply of needed pulpwood.

The re-growth of the forest and its management for timber production, however, has had marked effect on wildlife production. Certain species, such as sharp-tailed grouse have decreased in number. Others, such as deer and ruffed grouse, increased while the forest was in its young stages of growth. As it matures, however, the habitat for these species will become less and less favorable. On some public forest lands, modifications of forestry practices are being undertaken to benefit deer and ruffed grouse.

In general there has been a rapid decline in the farm population in favor of larger commercial enterprises, forestry and the recreation business. The total number of farms will continue to decrease. Migration from the farm is actually desirable since most of the farms are "marginal." However, more land is being cleared for cranberry production in some areas.

The expanding demand for more recreational use of both public and private forest lands is perhaps the most outstanding development in recent years. Building lines on highways, separating hotels and summer houses from busineses and boys and girls camps from summer home areas are examples of the problems which carefully worked out zoning ordinances may help solve. Some local communities are voluntarily, and with success, attempting to work out conflicts arising between fishermen and water skiers on some northern lakes.

Use of forest land was discussed at the recent meeting of the Wisconsin chapter of the SCSA. The panel included a wide variety of people interested in the problem.

Public confidence and understanding are essential to the success of any land-use program. With all groups working closely together with the public, our forest resources can be used by all people.

—RUTH L. HINE, *Secretary*
Wisconsin Chapter SCSA

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New Conservation Research Center in California

A new center for research on conservation of natural resources in northeastern California is being established with headquarters in Susanville.

A. L. Hormay has been appointed research leader for the center. Research will cover both timber and range management.

SCSA Members Receive USDA Awards

Several members of the Soil Conservation Society of America were honored recently by the United States Department of Agriculture at its Honor Awards Ceremony. Following are the citations for these men who received Distinguished Service Awards:

Lyle T. Alexander, Beltsville, Maryland

"For successfully using soil science and related sciences to advance human understanding of soil formation, behavior, and use, and of the effects of radioactive materials on soils and plants."

Elwood L. Demmon, Asheville, North Carolina

"For his success in furthering forest research, in stimulating public thinking toward wiser use of forest land and water resouce, and in helping shape national and regional forest policies."

The men who received the Superior Service Awards are:

Foster M. Patton, Cullman, Alabama

"For his unusually effective leadership and training of the Cullman Work Unit personnel which resulted in outstanding work performance."

Eugene J. Peterson, Washington, D. C.

"For achieving a high degree of cooperation and support of line and staff officials in the development of an effective system of inter-State training centers in the Soil Conservation Service."

Elmer L. Sauer, Urbana, Illinois

"For exceptional initiative and ability in conducting, interpreting, and reporting research in the economics of soil and water conservation which influenced many farmers to adopt conservation farming practices."

John A. Smart, Charlottesville, Virginia

"For his effectiveness in developing and stimulating employees, supervisors and leaders to promote and gain enthusiastic support of the soil conservation program within the State."

Robert A. Work, Portland, Oregon

"For developing a water supply forecasting program in the Western States which has provided advanced information to water users on probable water supplies for irrigation and other purposes."

Among the Soil Conservation Service Work Units receiving the Unit Award are: Beaver City, Nebraska; Lonoke, Arkansas; Lovell, Wyoming; and Malad City, Idaho.

Inventory of Soil and Water Conservation Needs Started by USDA

A national inventory of soil and water conservation needs has been launched by the U. S. Department of Agriculture.

Plans call for completing the initial inventory in three years, with periodic revisions thereafter to keep the figures up to date.

The inventory will be made for each county in the United States and for appropriate subdivisions of the Territories. It will provide basic facts for the amount and kind of soil, water, and plant resources as well as realistic estimates of conservation practices and measures needed to best protect and improve these resources.

In setting up the inventory program, Secretary Benson directed the Soil Conservation Service to carry out the study with the help of the Agricultural Conservation Program Service, Agricultural Research Service, Commodity Stabilization Service, Federal Extension Service, Farmers Home Administration and Forest Service. Other agencies of the Department will be called upon where they can make a contribution.

Representatives of these agencies will make up a National Soil and Water Conservation Needs Committee. This committee, with John W. Barnard of the Soil Conservation Service as chairman, will aid in the development and review of procedures, furnish guidance in the cooperative effort, and make periodic reviews of progress for the information of the participating agencies. Other members of the committee include James M. Hunt, ACPS; Dr. Buis T. Inman, ARS; Harris W. Soule, CSS; George H. Enfield, FES; Stephen C. Hughes, FHA; and James C. Rettie, FS.

In addition to the National Committee, comparable committees in the States and Territories will be named. Representatives on State committees will be from state and local agencies, organizations, and groups concerned with soil, water, forest, range and wildlife conservation. The State or Territorial Conservationist of the Soil Conservation Service, or one of his staff members, will serve as chairman.

The inventories at the county level will be developed by a committee in each county with supervision, assistance, and coordination furnished by State and Department Committees. Membership of these committees will consist of county-level representatives of federal, state and local agencies, including soil conservation districts, ASC Committees, drainage and irrigation districts, and others.

Estimates for public lands will be made by the agencies administering such lands. Federal agencies responsible for land management in other Departments will be asked to help obtain data which can be used in the inventory.

The Department's Soil and Water Conservation Needs Committee, upon completion of an operations policy and procedure statement within the framework of Secretary Benson's memorandum, will conduct ten training workshops. These will be attended by federal and state people who will serve on the Soil and Water Conservation Needs Committee in the various states.

"If they would stop the water *run-off* in the hills, there wouldn't be run off from the valleys."

Foresters Schedule National Meeting

"Forestry Faces Forward" is the theme of the 56th annual meeting of the Society of American Foresters to be held October 14 to 17 in Memphis, Tennessee.

Fred A. Wirt, a charter member of the SCSA, has retired as advertising manager for the J. I. Case Co.

Wirt was the first chairman of the SCSA finance committee. He was also a member of the council. He is well known over the country as a speaker on soil and water conservation subjects.

Wirt plans to move to his South Carolina farm where he will maintain a small herd of Polled Hereford cattle.

Firman E. Bear, editor of SOIL SCIENCE and past president of the SCSA, recently returned from a 63-day air trip around the earth by the way of Honolulu, Japan, Hong Kong, India, Jordan, Greece, Madrid, Lisbon and many points in between. Dr. Bear reported that the trip was extremely interesting and worth while.

Bon D. Grussing, manager of advertising, sales promotion, and public relations of Minneapolis-Moline Company, was recently named to the newly-created post of merchandising director. **John Rusinko,** assistant to Mr. Grussing, was promoted to advertising manager; **William W. Lundell,** advertising assistant, was named director of public relations.

J. S. Russell, first vice president of the SCSA, was awarded an Honorary Degree of Doctor of Laws by Grinnell College on June 3. Mr. Russell is presently farm editor of DES MOINES REGISTER AND TRIBUNE. He was formerly an agricultural consultant to the United States Department of State and wartime deputy food administrator for the Department of Agriculture.

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Practical . . . helpful . . . readable

4) FARM SOILS:
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Now in its fifth edition, this book presents the basic principles of soil and crop management and discusses soil adaptation, planting, and cultivation of important field crops. There are 330 clear illustrations and maps, including full color plates of 10 deficiency systems. A chapter on organic soils and new information on tilth and tillage has been added.

1956 439 pages 330 illus. $4.96

Revised and reorganized . . .

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By L. D. BAVER, Director, Experiment Station, Hawaiian Sugar Planters' Association.

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Annual Election Now in Progress

LATE IN 1954 *Soil Conservation Society of America* members voted to change the constitution to allow regional representation on the national council. In 1955 the Western Region elected H. A. Hopper of California under this arrangement. This year the Great Plains Region and the Southeastern Region are voting at the present time to elect regional representatives. In 1957 the North Central and Northeastern Regions will elect.

The intent of the change was to develop broader and possibly more effective interest in the *Society* from over the United States. Three council members will continue to be elected at-large. In addition, the immediate past president serves as a council member. Those elected to the council serve a three year term, thus regions will vote for regional representatives every third year.

Offices in the *Society*, i.e., president, first vice president, second vice president, and treasurer, serve a one year term.

How Nominations Are Submitted

Soon after each election the president for the ensuing year appoints a number of committees. In *S.C.S.A.* the nominating committee, according to the by-laws, acts more as a clearing house for nominations than in the usual and accepted manner for such committees. Paragraph 13 (d) of the by-laws reads: *"The list of candidates to be submitted by the nominations committee shall include all nominations duly presented in accordance with the provisions in 13 (e)."*

Paragraph 13 (e): *"Nominations by petition may be submitted to the nominations committee, (1) if adopted by a chapter at a regular or a special meeting called for such purpose; or (2) if presented by ten or more members of the Society who may or may not be members of a chapter. The nominations committee shall consider and in its discretion may submit nominations presented by an individual member."*

Secretary's Note:

(It is too late for additional nominations for 1956 election. However, the explanation of the process apparently needs clarification to the membership. It has been sent to chapter officers and has previously been in News Notes.)

All members should have recently received ballots for the current election. The ballots were due October 1, 1956.

A biographical sketch of candidates accompanied each ballot. The nominations committee submitted the following ballot:

For President.....J. S. Russell, Des Moines, Iowa

For First Vice President.....
.....Russell G. Hill, East Lansing, Michigan

For Second Vice President.....
.....I. O. Hembre, Madison, Wisconsin
.....J. K. Vessey, Milwaukee, Wisconsin

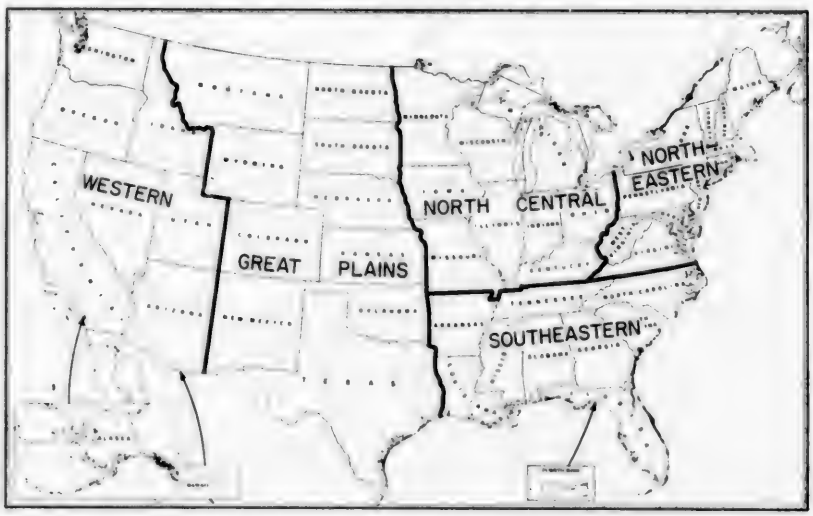
For Treasurer..Howard F. Barrows, Aurora, Illinois

For Council Member At Large.....
.....Walter C. Gumbel, Fairmont, West Virginia
.....H. E. Hecker, Lexington, Kentucky
.....Alvin C. Watson, Washington, D. C.

For Council Member (Southeastern Region)
.....A. H. Veazey, Raleigh, North Carolina

For Council Member (Great Plains Region)
.....H. G. Bobst, Lincoln, Nebraska
.....Ross D. Davies, Huron, South Dakota

Only members within each region are permitted to vote for regional representatives and the ballots have been prepared and mailed accordingly. The accompanying map locates regional boundaries.

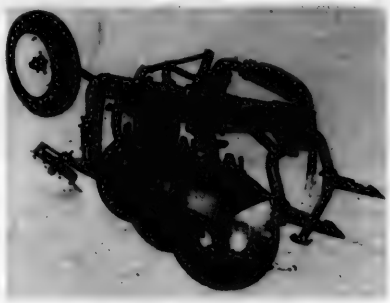


This map shows regional organization of the Soil Conservation Society of America as adopted by the membership in 1954.

Some New Industry Products

Two-Way Disk Plow Cuts Right or Left

A new two-way disk plow announced by International Harvester Company can plow an entire field without making a dead



furrow or a back furrow. This feature makes the plow especially suited for use in irrigated and terraced areas.

A hydraulic cylinder at the top rotates the plow disks either to the right or left and positions gauge and furrow wheels, permitting the operator to plow back and forth in the same furrow, always throwing the dirt the same direction. This plow is designed for use with the Farmall 300 and 400 tractors.

Ferguson Broadens Line With New "40" Tractor

This summer farmers all over the country will be looking over another new Ferguson tractor, the Ferguson "40", which has been just recently added to the Ferguson line. Slightly longer and heavier than the popular Ferguson "35", *still in the line*, the "40" has pads for mid-mounted implements, and features com-

pletely new styling as well as a new two-tone color scheme.

The new Ferguson "40" is a standard clearance 4-wheel tractor capable of pulling three plows in most soils. It retains the 4-Way Work Control features (Quadramatic Control, Variable-Drive PTO, "2-State" Clutching, Dual-Range Transmission) made famous by the Ferguson "35", as well as an advanced version of the time-tested and farm-proved Ferguson System. In addition it features power steering and power spaced rear wheels as options. Other innovations are a larger 17-gallon gas tank and a 12-volt electrical system.

Brady Corporation Improves Chopper

A new improved offset chopper has been released by The Brady Manufacturing Corporation, Des Moines, Iowa. After field tests, the manufacturer says the improved machine chops hay, silage and corn stalks at low cost.

The unit, mounted on the left side, comes equipped with 50 horsepower gear

box and with either chains or free-swinging chain knife cutters. The crushing action of the chain knives eliminates sharp ends that injure cattle mouths, says the manufacturer.

Allis-Chalmers Announces Twin-Wheel Drive Mower

An entirely new concept in mower design, a Twin-Wheel drive instead of the conventional pitman drive, was recently announced by Allis-Chalmers in its new No. 7 mower available both in rear-mounted and trail-type models, designed to match present-day tractor speeds and power.

Smooth non-stop rotary action of twin flywheels with heavy matching balanced counterweights drives the sickle and practically eliminates vibration because the start-and-stop action of the sickle is counterbalanced and smoothed out.

The Twin-Wheel drive is mounted directly on the cutter bar, permitting operation of the sickle at any angle from 90 degrees above horizontal to 45 degrees below horizontal. The hydraulic ram de-

termines the amount of lift. The sickle is powered through two short connecting rods in the same plane and always level with the sickle regardless of the angle or height of cut. The short stroke of 2½ inches at 1400 rpm makes possible up to 2800 cutting strokes a minute.

The twin flywheels balance each other and balance the sickle. Counter-weight action is always opposite to the direction of sickle travel.

The cutter bar on the No. 7 mower is also of new design. It is wider at the inner end where extra strength is needed and tapers to standard width at the outer end. Register is set at the factory. Lead and tile can be changed without affecting the register.

Ferguson Introduces Pull-Behind Baler

Especially designed for medium and small sized farms in the new low cost pull-

behind baler released by Ferguson. It produces standard 14-inch by 18-inch twine tied bales of either 30 or 38-inch lengths and can be used with any make

tractor. Capacity is five or more bales per minute.

This new baler is low and compact giving the operator full vision of the entire baling operation. Released in limited quantities this year, the new baler will be fully available in 1957.

New Manure Spreader Has Front-End Delivery

A new front-end, enclosed-delivery power take-off operated manure spreader has been announced by Allis-Chalmers. Easy to load, it is particularly clean for the tractor driver and the machine.

Three powerful, high-speed, turbine-type spreaders distribute material across a constant 12-foot width regardless of volume,

says the manfacturer. Spreading action is down and to the sides in full view of the operator. Velocity and direction of spread prevents material being carried by the wind. Capacity of the box is 110 bushels. Rate of spread ranges from 2 to 14 loads per acre.

Irrigation Pipe Now Reinforced

All sizes of Flo-Mor aluminum irrigation pipes are now available with reinforced

male ends at slight extra cost. The pipe is made by the Habco Manufacturing Company of Columbus, Nebraska. The company lists several advantages: (1) more rigid and rugged; (2) resists damage in shipping and field handling; (3) resists "ovality," maintaining its round shape for easier fit into couplers; (4) the pipe bead is strengthened; (5) resists band slippage; and (6) stands up better under high pressures.

New Irrigation Sprinkler Rotates By Water Pressure

The Vermeer Pow-R-Sprinkler consists of a huge 140 foot sprinkler boom which rotates on a 4-wheel trailer mounted turn-

table. The sprinkler boom is rotated by water pressure only, requiring neither hydraulic pump nor electricity. This outfit will cover more than 3 acres (up to a 500 foot circle) with ¼ to 1 inch of rain in one hour.

It is manufactured by the Vermeer Manufacturing Company of Pella, Iowa. The unit is designed to save as much as 80 per cent of the labor and time involved in sprinkler irrigation, says the company.

The Pow-R-Sprinkler may be pulled into the field by a tractor from either end of the trailer. The trailer also serves as a "carrier" for extra pipe needed as the unit is pulled deeper into the fields.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

President Eisenhower Issues Statement On New Watershed Amendment

"I have today approved H. R. 8570, a bill 'To amend the Watershed Protection and Flood Prevention Act.' This new law broadens the program now being carried out by the Secretary of Agriculture in cooperation with local organizations sponsoring land and water conservation projects.

"The general purposes of the new law are useful and in keeping with the concern which this Administration has continually expressed as to the need for a partnership between the Federal Government and the local people in conserving two of our most valuable resources—soil and water.

"I regret that in one respect the new law is a step backwards. Under its terms the Federal Government will be required to assume the full cost of building structural works which provide flood reduction benefits. The Department of Agriculture and other Executive agencies opposed this provision when the bill was under consideration by the Congress. I agree that their opposition was well founded.

"It is unfortunate that the Congress has chosen to write into the law an incentive to local people to shift to the Federal Government a burden in which they should be willing to invest their own money in a joint enterprise with the Federal Government.

"Fortunately, the immediate effects of this provision will not be great. I am convinced of the soundness of the partnership philosophy and of public acceptance of the principle of cost sharing on public works projects.

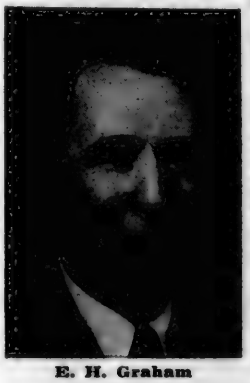
"I believe that, upon consideration of legislation which will be proposed to carry out the recommendations of the Presidential Advisory Committee on Water Resources Policy, the Congress will agree and will change this feature of the law. I shall so recommend when Congress is again in session."

News Notes

PRESIDENT'S COLUMN

Almost 100 years ago there appeared a book on conservation that was in many ways the prototype of all the many that have appeared since. Furthermore, it decidedly influenced the thinking of those who have provided leadership in the conservation movement as it has so remarkably developed during the past half-century in America. The book was MAN AND NATURE by George Perkins Marsh, published in New York in 1864. Even in that era of almost unbridled exploitation, the volume proved so popular that Marsh revised it in 1874 under the title THE EARTH AS MODIFIED BY HUMAN ACTION. Still later, in 1885, a posthumous revision was published.

Marsh was no visionary. Born in Vermont, he became a lawyer by profession and during his career entered the diplomatic service, holding among other foreign assignments the distinction of being the first United States Minister to Italy. He was an able linguist, which permitted him to gain first-hand knowledge of many resource problems in Europe and the Mediterranean, particularly as they related to forests and waters. He later helped the State of California develop its irrigation law. In his book, Marsh brought together for the first time many ideas concerning natural resources, particularly as attention had begun to focus on them abroad.



E. H. Graham

There has now appeared a weighty but attractive and intriguing volume of 1,200 pages dedicated to George P. Marsh and composing a centenary tribute to him. It is entitled MAN'S ROLE IN CHANGING THE FACE OF THE EARTH (*University of Chicago Press, 1193 pages, $12.50*). To those of us in the *Soil Conservation Society of America* this book is of unusual interest. It contains a collection of more than 50 illustrated articles by as many authors together with a transcription of the discussion which centered around their presentation. These persons, from all parts of the world, met in June of last summer at Princeton to participate in an international symposium on the subject of the volume. This inter-disciplinary conference was conducted under the joint chairmanship of Carl O. Saur, Marston Bates, and Lewis Mumford. It was sponsored by the Wenner-Gren Foundation for Anthropological Research.

As was the case with Marsh's book, this new volume takes the broad view of man and nature, and treats many aspects of what has happened and what is happening to the earth under man's influence. There are introductory papers on the effects of ancient peoples on their environment. A section of the book deals with alterations of climate, soil changes, and biotic modifications in the human habitat. There are presentations on the ecology of wastes, urban-industrial demands for land, and the limitations of man and the earth. But any noting of subjects gives little clue to the varied and informative contents of the book. Many of the authors are new to American readers in the conservation field, and some of the papers will seem overly philosophical or scholastic to many of us. But the book is guaranteed to give the reader a great deal that is new to him, and can scarcely fail to provide stimulation for relating his own knowledge and experience to aspects of conservation in other fields.

In the reflection that is unavoidable in comparing this recent volume with Marsh's book, one is likely to ponder the history

(*Continued on page* 256)

J. Selby Young on Special Assignment With Air Force

National council member, J. Selby Young of Colorado Springs, Colorado, has been requested by Secretary of the Air Force, Donald Quarles, to accept an assignment as a consultant and observer to visit Air Force installations in Labrador, Iceland, Germany, England, France, Italy, Greece, Turkey, Libya, Morocco, Spain, and the Azores.

Many Society members will remember Young at the 1953 annual meeting in Colorado Springs where he had charge of local arrangements. For many years he served with the Soil Conservation Service. Since World War II several activities have taken his time—he has managed his home farm, a real estate development near Colorado Springs, active in banking circles, and two years ago purchased the Highland Hereford Ranch. He has served as president of the Colorado Association of Soil Conservation District Supervisors, as president of the Colorado Springs Chamber of Commerce, chairman of Fountain Valley Soil Conservation District.

On his tour with the Air Force he will observe land use conditions in the various countries as well as land management practices as carried out at Air Force installations.

Young will make his tour during September and October.

Alvin F. Bull Serving As Editor of Journal

Alvin F. Bull, Des Moines, Iowa, is serving as Acting Editor of the JOURNAL OF SOIL AND WATER CONSERVATION. He succeeds Walter C. Gumbel who has edited the JOURNAL continuously since the first issue in 1946.

Bull is serving on a basis very similar to the manner in which the position was handled by Gumbel. In his daily work he is a field editor for *Wallaces' Farmer & Iowa Homestead* in Des Moines. He is a 1949 graduate of the Iowa State College in agronomy. For over a year after graduation he served on the staff of the *American Society of Agronomy* at Madison, Wisconsin.

Alvin F. Bull

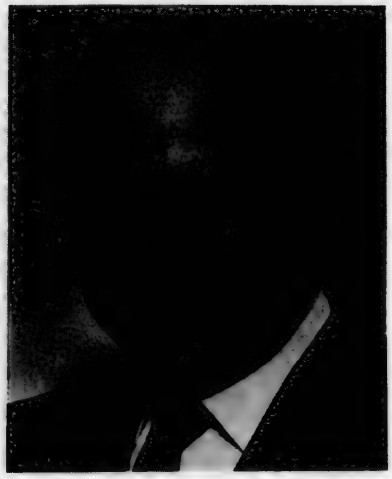
Active in the Iowa Chapter SCSA, Bull is married to the former Joyce Edgar, daughter of Professor and Mrs. Alvin Edgar of Iowa State College. They have two children, a son and a daughter. Joyce has a major in journalism and will assist with the JOURNAL. They plan to attend the *Society's* Eleventh Annual Meeting in Tulsa where *Society* members will have the opportunity to make their acquaintance.

Victor A. Surface in India

Victor A. Surface, formerly with the Soil Conservation Service in New Mexico and Arizona, is now in India as an agriculture Information Specialist for the International Cooperation Administration. He is assigned to the Indian Council of Agricultural Research, a branch of the Ministry of Food and Agriculture. His assignment is for two years. At the present time he has been attending workshops in the various state capitols for offiicials interested in agriculture. His address is Victor A. Surface, TCM/American Embassy, APO 74, Box N., San Francisco, California.

YOU'LL SEE THEM IN TULSA - OCT. 15-17

Myron Hurd
Chairman
Local Arrangements



Nolen Fuqua
President
National Association Soil Conservation Districts

The Oil Capital Chapter, Sweet Adelines, Inc., a group of lady singers that sing four-part harmony, barbershop style. George McCaslin, Director.

Charlie Chibitty
National Champion Indian Dancer

Double Creek

Convention delegates will tour Double Creek Pilot Watershed. At the right, Gladwin Young, Deputy Administrator, Soil Conservation Service and Harry Chambers, national council, SCSA, view map of watershed.

William J. Endersbee

Firman E. Bear

Herschel Newsom

Clifford Hope

All In Readiness For 11th Annual Meeting Clifford Hope, Banquet Speaker

The 1956 annual meeting of the *Soil Conservation Society of America* will feature an informative and interesting program, an educational tour for all participants, plans for lady visitors, and entertainment Oklahoma style. Members and others will not want to miss the *Society's* Eleventh Annual Meeting in Tulsa, Oklahoma, October 15, 16, 17, 1956.

Heading the Oklahoma welcoming group will be Nolen Fuqua, president of the National Association of Soil Conservation Districts, who will appear on the opening program. Ray Walker, State Conservationist, Soil Conservation Service; Shawnee Brown, Director of Extension, and many other Oklahoma personalities will greet the guests.

Keynote speaker on Monday, October 15, will be Herschel Newsom, Master of the National Grange. Banquet speaker will be Honorable Clifford Hope, Congressman from Kansas and past chairman of the House Agriculture Committee. A visit by the convention participants to Double Creek Pilot Watershed will be made. The pilot watersheds are organized under legislation introduced by Congressman Hope.

Dr. Firman E. Bear, member of the National Council *SCSA*, and retired as head of the Soils Department of Rutgers University, will preside at the banquet.

Other highlights will be discussions on "Factors Influencing the Establishment of a National Land Policy" by Horace J. Harper, and "Factors Influencing the Establishment of a National Water Policy" by Harold E. Thomas. (Please review the *July* JOURNAL OF SOIL AND WATER CONSERVATION for complete program coverage).

The three-day program is under the supervision of William J. Endersbee, of the Department of the Interior, who has served as chairman of the program committee.

Myron J. Hurd, chairman of the local arrangements for the convention has stated the ladies in attendance will journey to Will Rogers Memorial at Claremore on Tuesday afternoon and to Gilcrease Museum and Oak Ridge Country Club on Wednesday morning for talks on Western Art by Mr. Frank of Frankoma Pottery.

William L. Garman, Chairman of the entertainment has announced that Acree Blue Eagle will be master of ceremonies for the Indian dancers to appear at the barbecue on Monday night.

The Monday night free barbecue will be provided by the industries, business firms and friends of the *Society* in Oklahoma. It will be served under the direction of Clay Potts, genial Oklahoma A & M College "dean of barbecue."

Make your plans now to be in Tulsa! Reservations requests should be directed to: Tulsa Chamber of Commerce, Tulsa, Oklahoma. See the *July* JOURNAL for reservation form—or use the one recently mailed to you.

Honorary Members Deceased

A. G. Brown, retired manager of the Agricultural Commission, American Bankers Association, passed away in Toledo, Ohio, on June 28, 1956. Mr. Brown was elected an honorary member of the *Society* at Buffalo, New York, during the seventh annual meeting in 1952. He had a long and active career in the banking business and his conservation influence was nationwide.

Robert Lewis Rutter, Jr., well known soil conservation district supervisor from Ellensburg, Washington, recently passed away. Mr. Rutter was elected an honorary member of SCSA at the Memphis meeting in 1951. He had actively served the Washington Association of Soil Conservation District Supervisors and as president of the Washington Cattlemen's Association.

Another prominent American conservationist and active *Society* member, Louis Bromfield, passed away in May of 1956. He was a president of Friends of the Land and best known for his conservation books and writings about Malabar Farm.

Other *Society* members who have passed away in recent months include: Judson H. Zentmire, Audubon, Iowa; Ernest H. Webb, New Brunswick, N. J.; John W. Tilsy, Fayetteville, N. C.; E. P. Tichenor, Owensboro, Ky.; V. W. Thalmann, Honolulu, Hawaii; T. H. Stewart, Rock Hill, S. C.; Oswell P. Southerland, Oxford, N. C.; Paul Schiffer, Remus, Mich.; Don J. Phillips, Aurora, Ill.; C. R. Orton, Morgantown, W. Va.; William L. McMullen, Lincoln, Nebr.; F. D. Keim, Lincoln, Nebr.; Earl A. Illif, Fort Dodge, Iowa; Harry L. Hoegh, Milwaukee, Wisc.; John R. Herman, Oriental, N. C.; Fred B. Hamilton, Lincoln, Nebr.; Frank Feser, Claremont, S. Dak.; Raymond H. Ellis, Sioux Falls, S. Dak.; Malcolm Croft, Evergreen, Ala.; H. L. Crittenden, Des Moines, Iowa.; Edward A. Colman, Berkeley, Calif.; Chester W. Gee, Milwaukee, Wisc.

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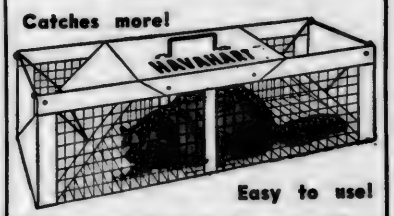

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Chapter News

New chairman of the San Francisco Bay Chapter is Fred A. Haughton, Jr. He succeeds Edward A. Colman who passed away earlier in the year. Plans for the Bay Chapter in 1957 call for working with the national organization in holding the 1957 national meeting at Asilomar on Monterey Peninsula, August 28-31, 1957.

A registration list of 64 names was compiled at the meeting of the Wisconsin Chapter held at the Trees for Tomorrow Camp, Eagle River, Wisconsin. The July event was a week end affair with panel discussions on Friday evening and Saturday morning on the general theme of forest land-use relationships. On Saturday afternoon a field trip was taken.

Craig Rosborough of Bentonville, Arkansas, was elected chairman of the Ozark Mountain Chapter at a meeting held in Fayetteville on July 20. John I. Smith, Agricultural Representative of the First National Bank of Fayetteville spoke on farm credit. At the July meeting the chapter made plans to encourage attendance at the national meeting of SCSA in Tulsa, Oklahoma, October 15-17, 1956.

Arizona

With Wayne Kessler in charge of the program, the Arizona Chapter SCSA held a meeting in Phoenix on June 5. Guest speaker was Dr. Harold E. Myers, Dean of the University of Arizona, College of Agriculture. Howard Passey, state range specialist gave an illustrated talk on range sites and conditions. John C. Walker is chairman of the Arizona Chapter.

Mississippi

The executive committee of the Mississippi Chapter met at Raymond on July 18 and appointed six statewide committees to carry on the work of the chapter during 1956 and to plan for the annual meeting on November 6 at which time H. Wayne Pritchard, executive secretary of the *Society* will meet with the members for the first time. Recently the chapter mailed a newsletter to all Mississippi members. D. T. Webb of Jackson is chairman of the chapter.

Pennsylvania

The Keystone Chapter of Pennsylvania held their annual meeting on August 17 and 18 at Millersville State Teachers College in Millersville, Pennsylvania. The chapter invited the William Penn Chapter of Philadelphia to meet with them. A. J. Wells, Head Sales Promotion Department, GLF Coop., Ithaca, New York and Dr. Jacob Freedman of the Geology Department of Franklin and Marshall College, Lancaster, Pennsylvania, spoke at the Friday session. Mr. Richard W. Campbell, insurance executive of Altoona, Pennsylvania was the speaker on Saturday morning. Later a tour was held for all in attendance.

Maine

Thirty-eight people registered for the Maine summer meeting of the Northern New England Chapter meeting at South Estabrook Hall on the campus of the University of Maine at Orono. Theme of the meeting was agronomy and chemicals. Several farms were visited where chemical sprays were used to combat weeds. In addition to the tour a speaking program, social and recreation period, and a business meeting were conducted.

Northern Illinois Chapter Activities Committee Reports

In searching for possible chapter activities the Northern Illinois Chapter appointed a committee to study and compile suggestions. The committee report is of value to other chapters and the suggestions they developed are listed below:

1. Provide counselors and advisors to youth groups, such as Boy and Girl Scouts, 4-H and FFA clubs, to help with conservation projects.
2. Provide speakers and program material for various groups such as church meetings, PTA, civic clubs, schools, radio and television.
3. Set up a committee to: (a) Compile a set of slides, movies, charts, literature, and diagrams to be available for such programs. (b) Compile a list of individuals who would like to take part in such programs. (c) Inform the various types of organizations that speakers and program material are available.
4. Suggest to the JOURNAL Editor that a series of page or half page articles be written to provide material for group programs.
5. Establish a committee to work with industrial management and labor leaders to help promote a better understanding of conservation among industrial workers. Develop a program for them to include meetings, tours, etc.
6. Arrange a chapter meeting, tour and picnic.

Four States Exceed Membership Goal

Oklahoma, Idaho, Maryland, South Dakota, and Colorado, have exceeded membership quotas as established by the national membership committee. Oklahoma has enrolled 301 new members since January 1, 1956, and now has the highest Society membership of any state. The membership gain and quotas are as follows:

State	New Members	Quota	Remaining Quota
Alabama	14	50	36
Arizona	22	25	3
Arkansas	6	25	19
California	21	70	49
Colorado	27	25	+ 2
Connecticutt	1	10	9
Delaware	1	10	9
Florida	23	50	27
Georgia	3	25	22
Idaho	37	20	+17
Indiana	9	50	41
Illinois	49	60	11
Iowa	32	50	18
Kansas	27	50	23
Kentucky	40	60	20
Louisiana	6	25	19
Maine	9	10	1
Maryland	36	35	+11
Massachusetts	4	20	16
Michigan	41	70	29
Minnesota	27	40	13
Mississippi	39	50	11
Missouri	4	60	56
Montana	12	25	13
Nebraska	34	50	16
Nevada	3	10	7
New Hampshire	1	10	9
New Jersey	18	50	32
New Mexico	12	25	13
New York	10	25	15
North Carolina	21	70	49
North Dakota	23	50	27
Ohio	32	70	38

(*Continued on page 256*)

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The Journal of Soil and Water Conservation is an excellent gift for the individual who is "first and foremost a conservationist."

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Latest ideas in print and picture are brought to you through the *Journal of Soil and Water Conservation*. You see them with each issue. But others should have copies too. The educator, librarian, district supervisor, civic and political leaders have daily need for the information you receive through the *Journal*.

Articles such as *"Vanishing Crop Land," "Protecting and Developing the Nation's Watersheds," "Water Yield and Public Land Management," "Land Use in Russia,"* are designed to keep conservation leaders abreast of the "science and art of good land use."

But for the articles to assist the leader, the *Journal* must be put within his reach.

Soil Conservation Society of America
838 Fifth Avenue, Des Moines 14, Iowa

Gentlemen:

I enclose _____ for _____ memberships in the Soil Conservation Society of America. Please send the Journal of Soil and Water Conservation to the following addresses:

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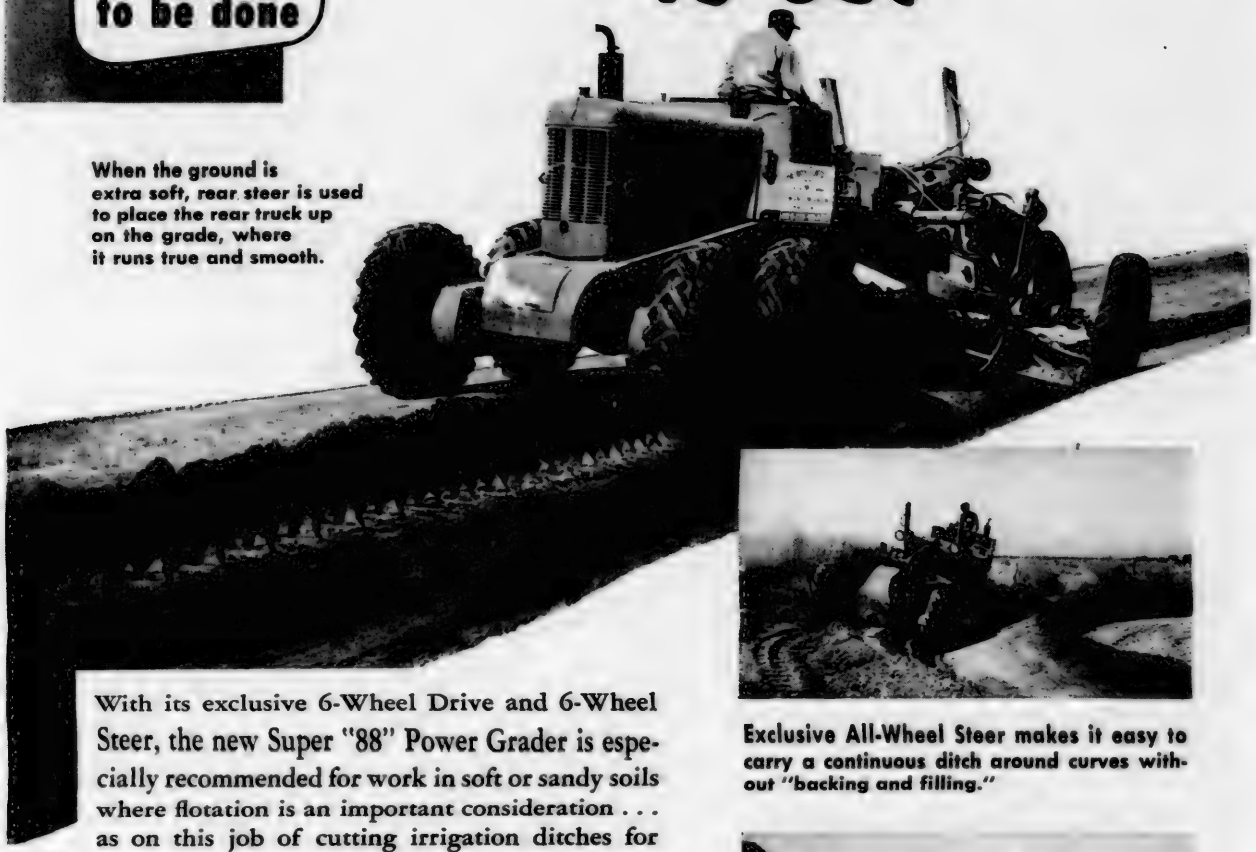
IRRIGATION DITCHES TO CUT



When the ground is extra soft, rear steer is used to place the rear truck up on the grade, where it runs true and smooth.

With its exclusive 6-Wheel Drive and 6-Wheel Steer, the new Super "88" Power Grader is especially recommended for work in soft or sandy soils where flotation is an important consideration . . . as on this job of cutting irrigation ditches for cotton near Phoenix, Arizona.

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We would welcome the opportunity to tell you more about this latest addition to the line of "power graders that have everything."

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Final ditch cuts are made with smooth precision, thanks to effortless, finger-tip hydraulic control.

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AURORA, ILLINOIS, U.S.A.

(*Continued from page 254*)

Oklahoma	301	100	+201
Oregon	4	20	16
Pennsylvania	15	30	15
Rhode Island	0	10	10
South Carolina	23	50	27
South Dakota	80	50	+30
Tennessee	33	50	17
Texas	22	50	28
Utah	3	20	17
Vermont	1	10	9
Washington	10	20	10
West Virginia	31	70	39
Wisconsin	26	70	44
Wyoming	0	20	20
District of Columbia	8	30	22
Puerto Rico	0	10	10
Canada	5	50	45
Foreign	85	50	+35
Miscellaneous	76	—	+76

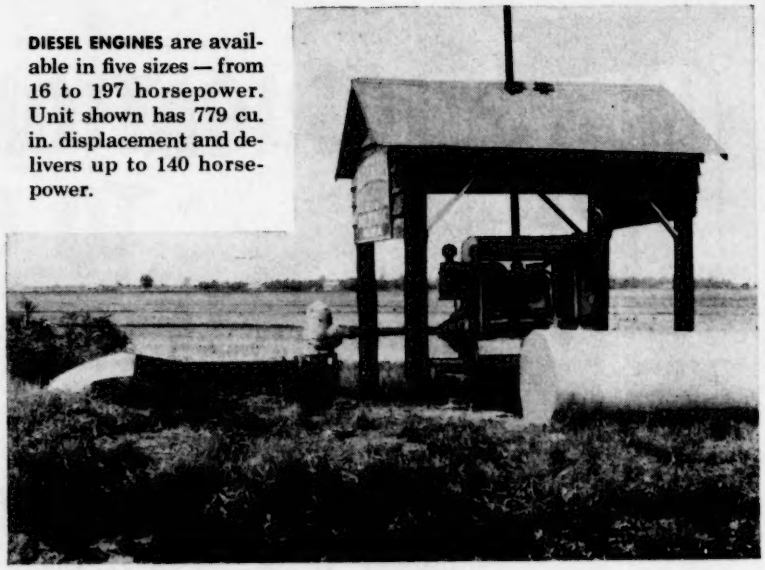
(*Continued from page 251*)

of the conservation movement. What about the word "conservation" itself, for instance, as its meaning relates to the care and use of natural resources? In a recent article in "American Forests" the author points out that, thirty years before Gifford Pinchot and Theodore Roosevelt popularized the word "conservation," it had been used in its modern sense. In 1875 in a meeting called in Chicago to plan a forestry organization, forerunner of the American Forestry Association, John A. Warder, Ohio physician, said that the purpose of the proposed organization was "the fostering of all interests of forest plantings and conservation on this continent." In MAN AND NATURE, however, Marsh devoted several pages of his first chapter to "physical conservation and restoration," more than a decade before Warder's comment. That Marsh was in fact thinking of conservation in essentially its modern connotation is shown by his statement that "It is evidently a matter of great moment . . . that the future operations of rural husbandry and of forest industry, in districts yet remaining substantially in their native condition, should be so conducted as to prevent the widespread mischiefs which have been elsewhere produced by thoughtless or wanton destruction of the natural safeguards of the soil."

It seems to me that one of the most significant things about the new book, MAN'S ROLE IN CHANGING THE FACE OF THE EARTH, especially in comparison with Marsh's lone dissertation, is that it illustrates the widespread attention conservation now demands. Here distinguished leaders in geography, biology, physics, economics, medicine, sociology, history, philosophy, climatology, populations, planning, and other seemingly unrelated subjects bring their minds to focus upon the single problem of man's relation to the earth that he inhabits.

The book and the symposium on which it was based provide one more reminder that the objective of the *Soil Conservation Society of America*—TO ADVANCE THE SCIENCE AND ART OF GOOD LAND USE—is a subject of ever growing importance, not only to the members of our *Society*, but to everyone in America and throughout the world today.

—EDWARD H. GRAHAM, *President*



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Irrigation is a proven way to boost crop yields and income. And Allis-Chalmers tractor-tough engines are a proven way to provide low-cost pumping power.

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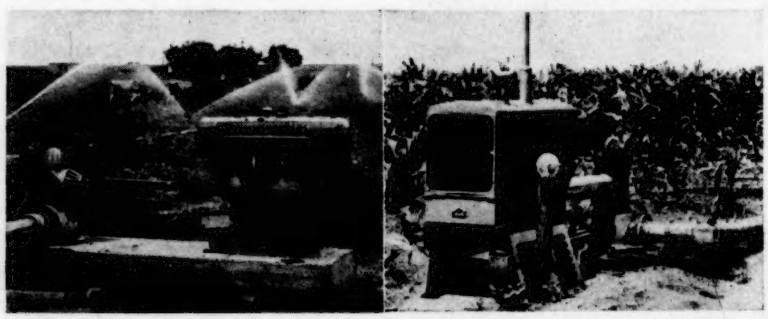
GASOLINE ENGINES are available in two sizes—delivering from 15 to 50 horsepower. Unit illustrated is the B-125.

ENGINES for BUTANE, PROPANE, or NATURAL GAS available with 125 and 226 cu. in. displacement. Engine shown is W-226 equipped for butane.



Owl Creek in floodtime . . .

A few years back, a freak cloudburst dumped 13 inches of rain onto one Oklahoma county in a single 24-hour day. It was like emptying milk cans into pie plates; the creeks filled in nothing flat, then took off cross-country.

But not Owl Creek. Its watershed centered on one man's farm, a man who got religion about conservation back when his neighbors were still planting in plumb lines. He terraced, contoured, strip-cropped, grassed his slopes and built earth dams. He worked as if he knew what was coming.

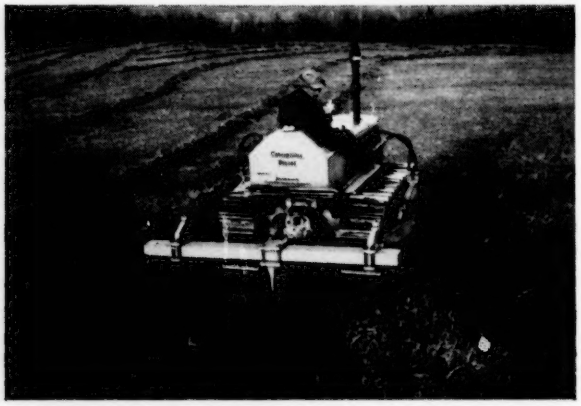
And his land sopped up most of this fantastic fall of water. His dams held the rest. The creek that rose on his property stayed within its banks. His topsoil stayed on his farm.

Except for the name of the creek, this is a true story. And equally true is the need for intelligent conservation practices—the kind recommended by Soil Conservation experts. The kind made low cost by farm machinery like Ferguson. Racine, Wisconsin.

Ferguson

Check the Soil Conservation Practices Approved for your county . . .

- ☐ Establish sod waterways by smoothing, preparing seedbed, seeding
- ☐ Build terraces
- ☐ Dig drainage and irrigation ditches
- ☐ Build tile outlets
- ☐ Dig ponds
- ☐ Level or shape land
- ☐ Improve contoured intertilled crops
- ☐ Establish strip cropping program
- ☐ Develop pasture including clearing, grading, filling, seedbed preparation, seeding
- ☐ Improve forest by clearing brushland, fencing, tree planting, seeding down legumes, pasture renovation
- ☐ Plow, till, subsoil land deep



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